

**Special Project Plan: 2020 Small-Mesh Bottom Trawl
Survey of Shrimp and Forage Fishes in the Kodiak
District**

by

Kally Spalinger

August 2020

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



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| Weights and measures (metric) | | General | | Mathematics, statistics | |
|---|--------------------|--|-------------------------------|--|-------------------------|
| centimeter | cm | Alaska Administrative Code | | all standard mathematical signs, symbols and abbreviations | |
| deciliter | dL | | AAC | | |
| gram | g | all commonly accepted abbreviations | e.g., Mr., Mrs., AM, PM, etc. | alternate hypothesis | H _A |
| hectare | ha | | | base of natural logarithm | <i>e</i> |
| kilogram | kg | all commonly accepted | | catch per unit effort | CPUE |
| kilometer | km | professional titles | e.g., Dr., Ph.D., R.N., etc. | coefficient of variation | CV |
| liter | L | | | common test statistics | (F, t, χ^2 , etc.) |
| meter | m | at | @ | confidence interval | CI |
| milliliter | mL | compass directions: | | correlation coefficient (multiple) | R |
| millimeter | mm | east | E | correlation coefficient (simple) | r |
| Weights and measures (English) | | north | N | covariance | cov |
| cubic feet per second | ft ³ /s | south | S | degree (angular) | ° |
| foot | ft | west | W | degrees of freedom | df |
| gallon | gal | copyright | © | expected value | <i>E</i> |
| inch | in | corporate suffixes: | | greater than | > |
| mile | mi | Company | Co. | greater than or equal to | ≥ |
| nautical mile | nmi | Corporation | Corp. | harvest per unit effort | HPUE |
| ounce | oz | Incorporated | Inc. | less than | < |
| pound | lb | Limited | Ltd. | less than or equal to | ≤ |
| quart | qt | District of Columbia | D.C. | logarithm (natural) | ln |
| yard | yd | et alii (and others) | et al. | logarithm (base 10) | log |
| Time and temperature | | et cetera (and so forth) | etc. | logarithm (specify base) | log ₂ etc. |
| day | d | exempli gratia | | minute (angular) | ' |
| degrees Celsius | °C | (for example) | e.g. | not significant | NS |
| degrees Fahrenheit | °F | Federal Information Code | FIC | null hypothesis | H ₀ |
| degrees kelvin | K | id est (that is) | i.e. | percent | % |
| hour | h | latitude or longitude | lat or long | probability | P |
| minute | min | monetary symbols | | probability of a type I error | |
| second | s | (U.S.) | \$, ¢ | (rejection of the null hypothesis when true) | α |
| Physics and chemistry | | months (tables and figures): first three | | probability of a type II error | |
| all atomic symbols | | letters | Jan,...,Dec | (acceptance of the null hypothesis when false) | β |
| alternating current | AC | registered trademark | ® | second (angular) | " |
| ampere | A | trademark | ™ | standard deviation | SD |
| calorie | cal | United States | | standard error | SE |
| direct current | DC | (adjective) | U.S. | variance | |
| hertz | Hz | United States of America (noun) | USA | population sample | Var var |
| horsepower | hp | U.S.C. | United States Code | | |
| hydrogen ion activity (negative log of) | pH | | | | |
| parts per million | ppm | U.S. state | use two-letter abbreviations | | |
| parts per thousand | ppt, ‰ | | (e.g., AK, WA) | | |
| volts | V | | | | |
| watts | W | | | | |

REGIONAL INFORMATION REPORT 4K20-09

**SPECIAL PROJECT PLAN: 2020 SMALL-MESH BOTTOM TRAWL
SURVEY OF SHRIMP AND FORAGE FISHES IN THE KODIAK
DISTRICT**

by

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Alaska Department of Fish and Game, Division of Commercial Fisheries, Kodiak

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Division of Sport Fish, Research and Technical Services
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TABLE OF CONTENTS

| | Page |
|--|------|
| LIST OF TABLES..... | ii |
| LIST OF FIGURES | ii |
| LIST OF APPENDICES | ii |
| ABSTRACT | 1 |
| INTRODUCTION | 1 |
| OBJECTIVES..... | 1 |
| METHODS..... | 1 |
| Survey Area and Design | 1 |
| Vessel and Fishing Gear | 2 |
| Temperature and Depth Data Logger | 2 |
| Catch Sampling | 2 |
| Determining Catch Weight | 2 |
| Species Composition Sampling | 3 |
| Shrimp Sampling | 3 |
| Fish Sampling | 4 |
| Additional Sampling Considerations | 5 |
| Data Entry | 7 |
| SCHEDULE AND DELIVERABLES | 7 |
| RESPONSIBILITIES | 8 |
| REFERENCES CITED | 8 |
| TABLES AND FIGURES | 9 |
| APPENDIX A. SMALL-MESH TRAWL SURVEY STATION MAPS | 23 |
| APPENDIX B. FORMS | 31 |
| APPENDIX C. SHRIMP SAMPLING..... | 39 |
| APPENDIX D. FISH AND JELLYFISH SAMPLING | 49 |

LIST OF TABLES

| Table | Page |
|---|------|
| 1. Species whole-haul sampled during small-mesh trawl survey. | 10 |
| 2. Species subsampled and measured on small-mesh trawl survey. | 11 |
| 3. List of species identified on the small-mesh trawl survey. | 12 |
| 4. Species collection list of rarely encountered organisms on small-mesh trawl survey. | 17 |

LIST OF FIGURES

| Figure | Page |
|--|------|
| 1. Kodiak shrimp management District in Registration Area J. | 18 |
| 2. Kodiak shrimp District small-mesh bottom trawl survey areas. | 19 |
| 3. Diagram of the 61 foot ADF&G small-mesh research trawl. | 20 |
| 4. Rigging for the 61 foot ADF&G small-mesh research trawl. | 21 |

LIST OF APPENDICES

| Appendix | Page |
|--|------|
| A1. Station boundaries and names, Chiniak Bay, 2020 Kodiak District small-mesh trawl survey. | 24 |
| A2. Station boundaries and names, Kazakof and, Kizhuyak bays, 2020 Kodiak District small-mesh trawl survey. | 25 |
| A3. Station boundaries and names, Izhut and Marmot bays, 2020 Kodiak District small-mesh trawl survey. | 26 |
| A4. Station boundaries and names, northern Shelikof Strait, 2020 Kodiak District small-mesh trawl survey. | 27 |
| A5. Station boundaries and names, southern Shelikof Strait, 2020 Kodiak District small-mesh trawl survey. | 28 |
| A6. Station boundaries and names, Uganik Bay, 2020 Kodiak District small-mesh trawl survey. | 29 |
| A7. Station boundaries and names, Uyak Bay, 2020 Kodiak District small-mesh trawl survey. | 30 |
| B1. Skipper trawl record form. | 32 |
| B2. On-deck sampling form – Species composition. | 34 |
| B3. Specimen collection form. | 37 |
| C1. On-deck shrimp identification photos. | 40 |
| C2. Differentiating ocean pink shrimp from northern pink shrimp. | 44 |
| C3. Shrimp measurement. | 45 |
| C4. Sexing pandalid shrimp in the laboratory. | 46 |
| D1. Biological measurements for finfish, sharks, and skates. | 50 |
| D2. Sex determination for sharks and skates. | 51 |
| D3. On-deck jellyfish identification photos. | 52 |

ABSTRACT

This report specifies special project objectives and methods for Alaska Department of Fish and Game's 2020 Kodiak District small-mesh bottom trawl survey of shrimp and forage fishes and presents the survey schedule and station boundaries. This project will sample shrimp and forage fish using small-mesh trawl gear in Chiniak, Marmot, Uganik, and Uyak bays, and Shelikof Strait, and provide abundance estimates and sex composition of pandalid shrimp populations that may be used by fishery managers when evaluating potential shrimp harvest.

Key words: shrimp, forage fish, trawl survey, small-mesh, Kodiak

INTRODUCTION

During September 2020, the Alaska Department of Fish and Game (ADF&G) will conduct a bottom trawl survey in areas of known pandalid shrimp habitat in the Kodiak Shrimp District of Westward Registration Area J (Figure 1), which includes Pacific Ocean waters south of the latitude of Cape Douglas (lat 58°51.10'N), west of long 149°W, and east of a line extending south from the Alaska Peninsula near Kilokak Rocks (long 156°20.22'W). Survey data is used to estimate distribution and abundance of pandalid shrimp populations, primarily northern pink shrimp *Pandalus borealis* and sidestriped shrimp *P. dispar*.

Since 1973, either ADF&G or the National Marine Fisheries Service (NMFS) have conducted small-mesh bottom trawl surveys in the Kodiak, Chignik, and South Peninsula districts using a high-opening box trawl. This survey was conducted annually in Pavlof and Chiniak bays, and other areas on a biennial or triennial schedule (Jackson 2003). In 2015, funding was reduced to a level where an independent small-mesh survey was no longer possible. However, the survey was maintained at a minimal level in Pavlof and Chiniak bays to provide a baseline to monitor shrimp population from 2016 to 2019. Additional funding available in 2020 will allow ADF&G to expand sampling efforts for 1 year to look more closely at areas that have become important to current and potential shrimp fishing efforts.

OBJECTIVES

The primary objectives for the 2020 small-mesh bottom trawl survey are as follows:

1. Estimate the abundance and sex composition of pandalid shrimp populations in the areas surveyed.
2. Determine spatial distribution, species composition, size frequency distribution, and density of forage fish and commercially important groundfish species from the areas surveyed.

METHODS

SURVEY AREA AND DESIGN

The small-mesh bottom trawl survey will be conducted in areas of known shrimp habitat (Figure 2), using a fixed-grid station design. Stations were initially created based on productive commercial shrimp fishing areas from the 1960s and 1970s, with consideration given to depth contours and trawlable habitat. Primary areas to be surveyed in 2020 are Chiniak and Marmot bays and Shelikof Strait. Uganik and Uyak bays will be surveyed if time and weather allow. Not all stations in each area are towed, and the intensity of the sampling effort will be dictated by budget considerations. Stations will be selected randomly within each bay or area. One tow will be made in each preselected station (Appendices A1–A7).

VESSEL AND FISHING GEAR

The research vessel *Resolution* (28.9 m) will be used to conduct the small-mesh trawl survey in 2020. The *Resolution* is a house-forward stern trawler equipped with an aft net reel, telescoping deck crane, and paired hydraulic trawl winches.

The survey net is a high-opening box trawl with 3 bridles developed by NMFS and adopted as the standard for shrimp trawl research by NMFS, ADF&G, and Department of Fisheries and Oceans of Canada (Watson 1987). This net was designed to sweep a 9.8 m path and open to a height of 4.0 m. It is constructed with 3.1 cm stretch mesh throughout the mouth, body, and codend. Net flotation is achieved with twenty-nine 16.6 cm floats attached to an 18.6 m long headrope. The net has an 18.6 m footrope with a 17.0 m tickler chain suspended by 29 cm dropper chains. The 3 dandylines are 1.8 cm in diameter and 18.2 m long. They are attached to Astoria “V” type doors weighing 340 kg and measuring 1.5 m by 2.1 m (Figures 3 and 4).

Within each selected station, the trawl is towed on bottom at a speed of 4.5 to 5.0 km/h for 1.85 km. The haul length provides a representative sample of fishery resources from each station, without exceeding weight limitations of vessel equipment. Irregular bottom type or net hangups may cause haul lengths to differ from 1.85 km. Haul length is determined by Global Positioning System and is assumed to be the distance traveled over ground by the vessel from when the footrope contacts bottom until the footrope leaves bottoms. The vessel captain estimates corrections in distance for hauls that are not straight. Haul location within station is determined by depth contours and trawlable substrate as determined from nautical charts and bottom mapping software on the vessel. All tows are made during daylight hours. Haul location, distance, depth, and time are recorded on the ADF&G Skipper trawl record form (Appendix B1). Quality of net performance is rated, and a haul is discarded and repeated when the skipper and cruise leader determine the net did not adequately sample the bottom. Deviations from standard towing procedure or sampling of alternative stations towed are noted in the comment section.

Temperature and Depth Data Logger

Depths and bottom temperatures are recorded by an RBRduo³ T.D. data logger (RBR Ltd. Ottawa, Canada) during each haul. The data logger is attached to the net’s headrope and is approximately 2 m above sea floor when fishing. Water temperature and depth are recorded in 30-second intervals for each haul. At the completion of the survey, data from the logger is downloaded, and temperatures recorded when the footrope is on the bottom are averaged to determine water temperature for each haul.

CATCH SAMPLING

Determining Catch Weight

Total catch weight from each haul is determined by weighing the full trawl codend with an electronic crane scale (MSI 9300; Measurement Systems International, Seattle, USA; ± 1.0 kg), emptying the codend into on-deck sorting bins, and subtracting the empty codend weight from the full codend weight. Total weight and empty codend weight are recorded on the on-deck sampling form (Appendix B2).

If the total catch is too large to be lifted by the crane, exceeds scale capacity (4,500 kg), or the sea state does not permit accurate weighing, catch weight is estimated by the cruise leader in consultation with the vessel captain. Factors considered when estimating catch weight may include

catch composition, previous catch weights from the area, and volumetric catch estimation (AFSC 2018).

A photo is taken of each haul before any fish have been removed for sampling to provide a qualitative record of catches and a useful visual aid for posters and presentations.

Species Composition Sampling

Prior to emptying trawl catch from the codend, a 1.5 m² subsampling net is tied into the on-deck sorting bin. After emptying the entire catch into the on-deck sorting bin, selected species (Table 1; whole-haul) are weighed using motion compensated electronic scales (Marel M1100, ± 0.01 kg; Marel P60, ± 0.001 kg; Gardabaer, Iceland), counted, and measured when applicable. Species names and weights are recorded on the on-deck sampling form (Appendix B2). A check mark is placed in the 100% column when a species is whole-haul sampled to indicate all are accounted for either by weight, count, or measurement. As whole-haul species are removed from the on-deck sorting bin for sampling, the subsampling net is lifted by crane through remaining catch (subsample) and placed on the sorting table for species composition sampling. Data recorded for the subsample will be used postsurvey to expand results to the entire haul catch.

All species on the sorting table are identified, weighed, and recorded on the on-deck sampling form (Appendix B2). In addition to whole-haul sampled species, forage fish and other commercially important groundfish in the subsample are measured using a magnetic fish measuring board (Table 2). The cruise leader must be familiar with the species list (Table 3) to ensure remaining organisms are correctly identified, counted, weighed, and recorded. Species of particular interest in the small-mesh survey that may be more difficult to identify are shrimps and jellyfish (Appendices C1 and D3). Unknown or unidentifiable species are weighed and recorded on the on-deck sampling form, the specimen is retained for postsurvey identification, and the specimen collection form (Appendix B3) is completed. Human-made products, kelp, empty shells, regurgitated fish, rocks, etc. in the subsample are classified as “debris” and are also weighed and recorded.

Animals weighed and measured are recorded in the *measured weights* column of the on-deck sampling form. Weights of unmeasured animals are recorded in the *unmeasured weights* column.

Counts of animals weighed and unmeasured are recorded in the *count of unmeasured: weighed* column. When the cruise leader determines too many organisms are present in a whole-haul sample to reasonably sort and weigh, organisms are counted by crew as they are returned to the water and counts are entered in the *count of unmeasured: unweighed* column. In this case an average weight is applied using data from the subsample.

Shrimp Sampling

The amount of shrimp in the subsample will determine the sampling protocol. If there are less than 4–5 kg of shrimp in the subsample, all shrimp should be speciated (Appendix C1) and weighed. *Shrimps of the Pacific coast of Canada* (Butler 1980) is the recommended taxonomic guide for identification. Circle the “Y” on the on-deck sampling form after *Were all shrimp on table sorted?* and record the sorted weight of each shrimp species in the *Sorted Weight* column. Only the primary pandalid species (northern pink, sidestriped, coonstriped *P. hypsinotus*, humpy *P. goniurus*, and ocean pink *P. jordani* shrimp) will be measured, and total subsample counts will be determined later using the average weight of measured shrimp. A count of the remaining unmeasured shrimp is recorded in the *Sorted Count* column.

If there is more than 4–5 kg of shrimp in the subsample all shrimp can be combined and weighed together. Circle “N” on the on-deck sampling form after *Were all shrimp on table sorted?* and record the weight of the unsorted shrimp in the *Total unsorted shrimp weight from table* column. A sample of 3–5 kg is then drawn from the unsorted shrimp for speciation (sub-subsample). Speciate, weigh, and count the shrimp in the sub-subsample as previously described. The composition of each species from the sub-subsample will be expanded to the total shrimp subsample weight—and subsequently to the entire catch.

Note: Special care should be taken to identify ocean pink shrimp. These are easily confused with northern pink shrimp. Northern pink shrimp have a prominent spine in the middle of their third abdominal segment that ocean pink shrimp lack (Appendix C2).

Shrimp Measurement

Carapace length measurements are collected from northern pink, sidestriped, coonstriped, humpy, and ocean pink shrimp. The target sample size per haul is 200 measurements per species. If that many individuals are not present in the sub-subsample, and time is available, the remainder of the subsample can be sorted and measured to meet sampling goals. Shrimp measurements are made from the right eye socket to the midpoint on the posterior margin of the carapace (Appendix C3). Weigh the measured shrimp and record in *Measured Weight* column in the lower section of the on-deck sampling form. Measurements are electronically recorded in the survey catch database using digital calipers accurate to ± 0.01 mm.

Biological Shrimp Data

Samples of pink and sidestriped shrimp from each haul are collected and frozen to be sexed later in the laboratory. Each sample should be representative of the sizes in the subsample and can include up to a gallon of both measured and unmeasured shrimp from the haul. If there is not a full gallon of shrimp available, save and freeze all shrimp possible. Each shrimp sample bag should be labeled with species, haul number, bay/area name, and date. A goal of 300 shrimp per species in each bay will be sexed, measured, and weighed in the laboratory (Appendix C4).

Fish Sampling

Weight and length measurements are taken from most forage fish and finfish species (Tables 1 and 2). Length measurements are recorded on deck directly into the survey catch database. Pacific halibut *Hippoglossus stenolepis* and skate measurements may alternatively be written on the on-deck sampling form and entered into the database after the haul. Pacific halibut and skates are often difficult to fit on the scale, so weights are estimated from length data.

Fish Measurement

Fish measurements are recorded on deck with a magnetic fish measuring board that transmits data directly into the survey catch database. Target sample size is 30 to 50 measurements per species. To avoid bias and ensure a representative sample, the cruise leader collects length samples from a predetermined quadrant of the sampling table. Deviations from standard sampling procedures are described on the on-deck sampling form.

Forage fishes and commercial finfish species are measured from snout to midpoint of the caudal fin (Appendix D1). All sharks and skates are measured and sexes recorded. Sharks are measured from snout to tip of caudal fin. Skates are measured along the dorsal surface from the snout to the

anterior notch of the pectoral fin. Sex is determined by the presence (male) or absence (female) of claspers (Appendix D2). Sharks and skates that are difficult to sex are recorded as unknown.

Adult Walleye Pollock Sampling

Generally, walleye pollock *Gadus chalcogrammus* are whole-haul sampled (Table 1); however, there are hauls when pollock are so abundant they cannot all be sampled in a timely manner. In those instances, the cruise leader uses the following guidelines to determine the best sampling plan.

1. If less than 30 pollock are brought to the sorting table in the subsampling net, then pollock are whole-haul sampled. All pollock in the catch must be accounted for by weight or count. Target sample size is 30 to 50 pollock measurements from the sorting table and the on-deck sorting bin. Remaining pollock are weighed and returned to the water (*Unmeasured Weights*) or counted as they are released over the side of the vessel (*Count of unmeasured: unweighed*). Average weight of the measured fish is used to estimate the weight or count of unmeasured fish.
2. If more than 30 pollock are brought to the sorting table in the subsampling net, subsampling methods are used. Target sample size is 30 to 50 pollock measurements from the sorting table. Remaining pollock on the sorting table are weighed and returned to the water (*Unmeasured Weights*). Pollock left in the on-deck sorting bin are returned to the water immediately with the rest of the catch.

These guidelines are also used when a large catch of Pacific cod *Gadus macrocephalus*, sablefish *Anoplopoma fimbria*, rockfish *Sebastes* spp. and *Sebastolobus* spp., or other typically whole-haul sampled fish species are encountered.

Juvenile Fish and Forage Fish

Juvenile fish and forage fish may be caught in very large quantities by the small-mesh net. These fish are subsampled independently from adult fish. Juvenile fish are defined as the young of the year. Walleye pollock and Pacific cod juveniles are generally less than 14 cm in October.

Juveniles are sorted strictly from the subsample and up to 50 measurements are collected in addition to the 30 to 50 fish sample size of adult fish. Care must be taken not to confuse walleye pollock, Pacific cod, and Pacific tomcod *Microgadus proximus* juveniles or small Pacific herring *Clupea pallasii*, Pacific sandfish *Trichodon trichodon*, eulachon *Thaleichthys pacificus*, and capelin *Mallotus villosus*.

Additional Sampling Considerations

Specimen Collection

Photos of rarely encountered species (Table 4) are used to supplement the marine fish and invertebrate field guide (Byersdorfer and Watson 2010). Organisms are placed on a white or black background to show contrast, and multiple photos taken of dorsal, ventral, and lateral views. Fins or legs are spread as much as possible and close-up photos of distinguishing characteristics taken. If identification of any organism is questionable, the animal is photographed and frozen with a completed specimen identification form (Appendix C3) included in the sample bag.

Crab Pots

Crab pots are occasionally caught in the survey net, particularly inside bays with a history of crab fishing. The cruise leader and vessel captain determine if fishing ability was compromised by using

information about when during the haul the pot may have been caught (e.g., vessel speed may have changed) and where in the net it was caught or snagged (e.g., drag on the wires or net damage). If fishing ability is compromised the haul is considered unsuccessful and will be repeated.

Pots are usually removed from the net as the net is brought onboard, before the codend is weighed. All animals inside the pot are removed and included with the remainder of the catch before pots are disposed of. If the pot is retained in the codend, it is weighed with the total catch. Upon removal, animals inside the pot are included with the remainder of the catch, and the empty pot weighed separately. The weight is entered on the on-deck sampling form as *Whole-hauled debris weight*.

Large Debris Items

Large debris (e.g., rocks, logs, 50-gallon drums) are sometimes captured in the codend. These items are weighed separately and entered on the sampling form as *Whole-hauled debris weight*. Small debris items in the subsampling net are treated as part of the subsample.

When an item is caught in the net but unable to make it to the codend, it is removed and discarded without weighing. The cruise leader and vessel captain determine if fishing ability was compromised and repeat the haul if necessary.

Mud or Shell Hash in Catch

In some survey areas the seafloor is predominantly mud and the net can pick up a substantial amount of substrate. If the cruise leader estimates more than 10% of catch is mud, then the proportion of mud in the catch is estimated. This is done by weighing a portion of the catch with mud included, washing the mud from the catch, and reweighing. The proportion of mud is expanded to the total catch and subtracted from the total animal weight.

Hauls containing large volumes of shell hash (i.e., broken shells) mixed with small invertebrates may require additional subsampling. As an alternative to sorting all the shell hash mixture in the subsample, the cruise leader weighs and sorts a representative portion (sub-subsample) of the unsorted mix. All organisms in the sub-subsample are identified, weighed, and counted, and broken shells are weighed as debris. The remaining unsorted mixture is weighed. Composition of the sub-subsample is expanded to the unsorted shell hash mixture.

Unrepresentative Subsample

When the subsampling net does not contain a representative sample of total catch, the cruise leader may direct crew to add catch to the subsample. This can be accomplished by using deck shovels to add catch to the subsampling net before it is taken to the table, or by filling baskets with catch from the on-deck sorting bin and adding to the subsample table. The cruise leader supervises this procedure to assure a representative sample is taken. Alternatively, the cruise leader directs the crew to sort the entire catch.

Small Total Catch

When the total catch is 250 kg or less, the cruise leader may decide to sort the entire catch. The entire contents of the codend are emptied directly onto the sorting table, sorted, weighed, and measured according to standard sampling procedures.

Data Entry

After all catch from each haul has been sorted, identified, weighed, measured, and returned to the water, data not entered into the database during the sampling process must be entered. Species and weight data, as well as any halibut and skate lengths written on the on-deck sampling form, are manually entered into the survey catch database. Data from skipper forms are manually entered into the survey catch database at the end of each day.

In case of equipment failure, data should be manually recorded on a sheet of paper and entered into the database in the office.

Upon completion of the season, all data is verified, edited as needed, and given to the database manager for incorporation into the small-mesh trawl survey database where it will be summarized and analyzed.

Data Forms and Sample Custody

The cruise leader is responsible for completing all data forms and removing samples and data from vessel after each survey leg, including creating backup copies of electronic data. Data forms and electronic data removed from vessel are taken to the large-mesh trawl survey project leader. Boxes of frozen shrimp samples are labeled with project, year, and contact name and transferred to the freezer at the ADF&G laboratory where samples will be processed. The project leader must be notified of the location of all stored samples.

SCHEDULE AND DELIVERABLES

Schedule of activities for 2020 small-mesh trawl survey:

| Date | Activity |
|----------------|---|
| September 8–20 | Kodiak District survey (~13 days) |
| September 21 | Final data delivered to the Division of Commercial Fisheries in Kodiak for editing and analysis |
| Sept 25–Oct 31 | Process samples in laboratory for sex composition |
| March 15 | Final data results and potential shrimp fishery openings determined and distributed to fishery managers for consideration |
| June 1 | Draft report to management supervisor |

Small-mesh trawl survey data is maintained by ADF&G, Division of Commercial Fisheries in Kodiak. Electronic data is stored in a database on a network server in Kodiak, and is accessible by ADF&G staff and available to the public upon request.

RESPONSIBILITIES

List of personnel and duties

Fisheries Biologist II–Kally Spalinger, Project leader: Manage survey budgets, develop survey schedule, prepare sampling gear, and perform data verification/editing, data analysis, and report writing. Act as cruise leader as needed; oversee field activities and assist with sampling, data collection, and data entry.

Fisheries Biologist I–Michael Knutson: Assist project leader to prepare sampling gear, and perform data verification/editing, data analysis, and report writing. Act as cruise leader; oversee field activities and assist with sampling, data collection, and data entry.

Fish and Wildlife Technician III–Collin Hakkinen: Assist with sampling, data collection, and data entry while at sea.

Fish and Wildlife Technician III–Sherry Barker: Assist with sampling, data collection, and data entry while at sea, process collected samples in the laboratory for sex composition.

Boat Officer IV–Denis Cox: Operate survey vessel.

Boat Officer III–Kurt Pedersen: Vessel engineer, deploy/retrieve survey gear, assist with catch sampling.

Boat Officer II–Gary Wilson: Deploy/retrieve survey gear, assist with catch sampling.

Analyst/Programmer IV–Ric Shepard: Program and manage the trawl survey database, upload data and create data verification queries.

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TABLES AND FIGURES

Table 1.–Species whole-haul sampled during small-mesh trawl survey.

| Common name | Species name | Counted | Weighed | Measured |
|-----------------------|---|---------|---------|----------|
| Alaska skate | <i>Bathyraja parmifera</i> | | | ✓ |
| Aleutian skate | <i>Bathyraja aleutica</i> | | | ✓ |
| Armhook squid (adult) | <i>Berryteuthis magister</i> | ✓ | ✓ | |
| Atka mackerel | <i>Pleurogrammus monopterygius</i> | | ✓ | ✓ |
| Bering skate | <i>Bathyraja interrupta</i> | | | ✓ |
| Bering wolffish | <i>Anarhichas orientalis</i> | ✓ | ✓ | |
| Big skate | <i>Raja binoculata</i> | | | ✓ |
| Box crab | <i>Lopholithodes foraminatus</i> | ✓ | ✓ | |
| Dungeness crab | <i>Metacarcinus magister</i> | | ✓ | ✓ |
| Giant Pacific octopus | <i>Octopus dofleini</i> | ✓ | ✓ | |
| Giant wrymouth | <i>Cryptocanthodes giganteus</i> | ✓ | ✓ | |
| Golden king crab | <i>Lithodes aequispinus</i> | | ✓ | ✓ |
| Horsehair crab | <i>Erimacrus isenbeckii</i> | ✓ | ✓ | |
| Lingcod | <i>Ophiodon elongates</i> | | ✓ | ✓ |
| Longnose skate | <i>Raja rhina</i> | | | ✓ |
| Pacific cod | <i>Gadus macrocephalus</i> | ✓ | ✓ | ✓ |
| Pacific halibut | <i>Hippoglossoides stenolepis</i> | | | ✓ |
| Pacific sleeper shark | <i>Somniosus pacificus</i> | | ✓ | ✓ |
| Red king crab | <i>Paralithodes camtschatica</i> | | ✓ | ✓ |
| Red sea cucumber | <i>Parastichopus californicus</i> | ✓ | ✓ | |
| Rockfish spp. | <i>Sebastes</i> spp. and <i>Sebastolobus</i> spp. | | ✓ | ✓ |
| Sablefish | <i>Anoplopoma fimbria</i> | | ✓ | ✓ |
| Salmon spp. | <i>Onchorynchus</i> spp. | | ✓ | ✓ |
| Salmon shark | <i>Lamna ditropis</i> | | ✓ | ✓ |
| Spiny dogfish | <i>Squalus acanthius</i> | | ✓ | ✓ |
| Tanner crab | <i>Chionoecetes bairdi</i> | ✓ | ✓ | ✓ |
| Walleye pollock | <i>Gadus chalcogrammus</i> | ✓ | ✓ | ✓ |
| Weathervane scallop | <i>Patinoplectin caurinus</i> | ✓ | ✓ | ✓ |
| Wolf eel | <i>Anarrhichthys ocellatus</i> | ✓ | ✓ | |

Table 2.—Species subsampled and measured on small-mesh trawl survey.

| Common name | Scientific name |
|-----------------------------|--|
| Alaska plaice | <i>Pleuronectes quadrituberculatus</i> |
| Arrowtooth flounder | <i>Atheresthes stomias</i> |
| Butter sole | <i>Isopsetta isolepis</i> |
| Capelin | <i>Mallotus villosus</i> |
| Deep sea smelt unidentified | Bathylagidae |
| Dover sole | <i>Microstomus pacificus</i> |
| English sole | <i>Parophrys vetulus</i> |
| Eulachon | <i>Thaleichthys pacificus</i> |
| Flathead sole | <i>Hippoglossiodes elassodon</i> |
| Juvenile Pacific cod | <i>Gadus macrocephalus</i> |
| Juvenile pollock | <i>Gadus chalcogrammus</i> |
| Kelp greenling | <i>Hexagrammos decagrammus</i> |
| Northern rock sole | <i>Lepidopsetta polyxystra</i> |
| Pacific sandfish | <i>Trichodon trichodon</i> |
| Pacific tomcod | <i>Microgadus proximus</i> |
| Rainbow smelt | <i>Osmerus mordax</i> |
| Rex sole | <i>Glyptocephalus zachirus</i> |
| Rock greenling | <i>Hexagrammos lagocephalus</i> |
| Rock sole unidentified | <i>Lepidopsetta</i> sp. |
| Saffron cod | <i>Eleginus gracilis</i> |
| Sand lance unidentified | <i>Ammodytes</i> sp. |
| Sand sole | <i>Psettichthys melanostictus</i> |
| Slender sole | <i>Lyopsetta exilis</i> |
| Southern rock sole | <i>Lepidopsetta bilineata</i> |
| Starry flounder | <i>Platichthys stellatus</i> |
| White-spotted greenling | <i>Hexagrammos stelleri</i> |
| Yellowfin sole | <i>Limanda aspera</i> |

Table 3.—List of species identified on the small-mesh trawl survey.

| Common Name | Scientific Name | Common Name | Scientific Name |
|-------------------------|--|-----------------------------|--|
| fish larvae unident. | | <u>Poachers (continued)</u> | |
| <u>Sharks</u> | | longnose poacher | <i>Leptagonus leptorhynchus</i> |
| salmon shark | <i>Lamna ditropis</i> | sawback poacher | <i>Leptagonus frenatus</i> |
| spiny dogfish shark | <i>Squalus acanthius</i> | spinycheek starsnout | <i>Bathyagonus infraspinus</i> |
| Pacific sleeper shark | <i>Somniosus pacificus</i> | blackfin poacher | <i>Bathyagonus nigripinnis</i> |
| <u>Skates</u> | | sturgeon poacher | <i>Podothecus accipenserinus</i> |
| skate egg case unident. | Rajidae egg case | Aleutian alligatorfish | <i>Aspidophoroides bartoni</i> |
| big skate | <i>Raja binocularata</i> | fourhorn poacher | <i>Hypsagonus quadricornis</i> |
| Bering skate | <i>Bathyrāja interrupta</i> | sand lance unid. | <i>Ammodytes</i> sp. |
| longnose skate | <i>Raja rhina</i> | wolf eel | <i>Anarrhichthys ocellatus</i> |
| mud skate | <i>Bathyrāja taranetzi</i> | Bering wolffish | <i>Anarrhichas orientalis</i> |
| Alaska skate | <i>Bathyrāja parmifera</i> | sablefish (black cod) | <i>Anoplopoma fimbria</i> |
| Aleutian skate | <i>Bathyrāja aleutica</i> | deep sea smelt unident. | <i>Bathylagidae</i> |
| <u>Flatfish</u> | | northern ronquil | <i>Ronquilus jordani</i> |
| flatfish larvae | <i>Pleuronectiformes larvae</i> | searcher | <i>Bathymaster signatus</i> |
| arrowtooth flounder | <i>Atheresthes stomias</i> | <u>Pacific herring</u> | <i>Clupea pallasii</i> |
| Pacific halibut | <i>Hippoglossus stenolepis</i> | <u>Sculpin</u> | |
| flathead sole | <i>Hippoglossoides elassodon</i> | sculpin unident. | Cottidae |
| slender sole | <i>Lyopsetta exilis</i> | threaded sculpin | <i>Gymnocanthus pistilliger</i> |
| English sole | <i>Parophrys vetulus</i> | armorhead sculpin | <i>Gymnocanthus galeatus</i> |
| Dover sole | <i>Microstomus pacificus</i> | darkfin sculpin | <i>Malacocottus zonurus</i> |
| rex sole | <i>Glyptocephalus zachirus</i> | red Irish lord | <i>Hemilepidotus hemilepidotus</i> |
| yellowfin sole | <i>Limanda aspera</i> | yellow Irish lord | <i>Hemilepidotus jordani</i> |
| starry flounder | <i>Platichthys stellatus</i> | scissortail sculpin | <i>Triglops forficata</i> |
| sand sole | <i>Psettichthys melanostictus</i> | spectacled sculpin | <i>Triglops specticua</i> |
| rock sole unident. | <i>Lepidopsetta</i> sp. | ribbed sculpin | <i>Triglops pingeli</i> |
| northern rock sole | <i>Lepidopsetta polyxystra</i> | roughspine sculpin | <i>Triglops macellus</i> |
| southern rock sole | <i>Lepidopsetta bilineata</i> | great sculpin | <i>Myoxocephalus polyacanthocephalus</i> |
| butter sole | <i>Isopsetta isolepis</i> | plain sculpin | <i>Myoxocephalus jaok</i> |
| Alaska plaice | <i>Pleuronectes quadrituberculatus</i> | Pacific staghorn sculpin | <i>Leptocottus armatus</i> |
| <u>Poachers</u> | | soft sculpin | <i>Gilbertidia sigalutes</i> |
| tubenose poacher | <i>Pallasina barbata</i> | <i>Eunophrys</i> sp. | <i>Eunophrys</i> sp. |

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Table 3.–Page 2 of 5.

| Common Name | Scientific Name | Common Name | Scientific Name |
|----------------------------|------------------------------------|-------------------------|-----------------------------------|
| <u>Sculpin (continued)</u> | | eulachon | <i>Thaleichthys pacificus</i> |
| spinyhead sculpin | <i>Dasycottus setiger</i> | capelin | <i>Mallotus villosus</i> |
| crested sculpin | <i>Blepsias bilobus</i> | rainbow smelt | <i>Osmerus mordax</i> |
| silverspotted sculpin | <i>Blepsias cirrhosus</i> | Chinook salmon | <i>Oncorhynchus tshawytscha</i> |
| grunt sculpin | <i>Rhamphocottus richardsonii</i> | pink salmon | <i>Oncorhynchus gorbuscha</i> |
| bigmouth sculpin | <i>Hemitripterus bolini</i> | chum salmon | <i>Oncorhynchus keta</i> |
| thorny sculpin | <i>Icelus spiniger</i> | sockeye salmon | <i>Oncorhynchus nerka</i> |
| Pacific sandfish | <i>Trichodon trichodon</i> | quillfish | <i>Ptilichthys goodei</i> |
| <u>Gadids</u> | | dwarf wrymouth | <i>Cryptacanthodes aleutensis</i> |
| Pacific tomcod | <i>Microgadus proximus</i> | giant wrymouth | <i>Cryptacanthodes giganteus</i> |
| Pacific cod | <i>Gadus macrocephalus</i> | <u>Pricklebacks</u> | |
| juvenile cod | <i>Gadus macrocephalus</i> | daubed shanny | <i>Lumpenus maculatus</i> |
| Pacific cod-tagged | <i>Gadus macrocephalus</i> | slender eelblenny | <i>Lumpenus fabricii</i> |
| saffron cod | <i>Eleginus gracilis</i> | snake pricklyback | <i>Lumpenus sagitta</i> |
| walleye pollock | <i>Gadus chalcogrammus</i> | longsnout pricklyback | <i>Lumpenella longirostris</i> |
| juvenile pollock | <i>Gadus chalcogrammus</i> | decorated warbonnet | <i>Chirolophis decoratus</i> |
| greenling unident. | Hexagrammidae | whitebarred pricklyback | <i>Poroclinus rothrocki</i> |
| lingcod | <i>Ophiodon elongatus</i> | prowfish | <i>Zaprora silenus</i> |
| Atka mackerel | <i>Pleurogrammus monopterygius</i> | <u>Eelpouts</u> | |
| masked greenling | <i>Hexagrammos octogrammus</i> | eelpout unident. | Zoarcidae |
| whitespotted greenling | <i>Hexagrammos stelleri</i> | Alaska eelpout | <i>Bothrocara pusillum</i> |
| rock greenling | <i>Hexagrammos lagocephalus</i> | wattled eelpout | <i>Lycodes palearis</i> |
| kelp greenling | <i>Hexagrammos decagrammus</i> | shortfin eelpout | <i>Lycodes brevipes</i> |
| smooth lumpsucker | <i>Aptocycclus ventricosus</i> | <u>Rockfish</u> | |
| Pacific spiny lumpsucker | <i>Eumicrotremus orbis</i> | rockfish unident. | <i>Sebastes</i> sp. |
| <u>Snailfish</u> | | shortspine thornyhead | <i>Sebastolobus alascanus</i> |
| snailfish unident. | Liparidae | rougheye rockfish | <i>Sebastes aleutianus</i> |
| marbled snailfish | <i>Liparis dennyi</i> | blackspotted rockfish | <i>Sebastes melanostictus</i> |
| variegated snailfish | <i>Liparis gibbus</i> | Pacific ocean perch | <i>Sebastes alutus</i> |
| blotched snailfish | <i>Crystallichthys cyclospilus</i> | silvergray rockfish | <i>Sebastes brevispinis</i> |
| monster snailfish | <i>Careproctus phasma</i> | dark rockfish | <i>Sebastes ciliatus</i> |
| salmon snailfish | <i>Careproctus rastrinus</i> | dusky rockfish | <i>Sebastes variabilis</i> |

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Table 3.–Page 3 of 5.

| Common Name | Scientific Name | Common Name | Scientific Name |
|-----------------------------|------------------------------|----------------------------------|----------------------------------|
| <u>Rockfish (continued)</u> | | isopod unident. | Isopoda |
| darkblotched rockfish | <i>Sebastes crameri</i> | barnacle unident. | Thoracica |
| yellowtail rockfish | <i>Sebastes flavidus</i> | <u>Shrimp</u> | |
| quillback rockfish | <i>Sebastes maliger</i> | dock shrimp | <i>Pandalus danae</i> |
| black rockfish | <i>Sebastes melanops</i> | ocean pink shrimp | <i>Pandalus jordani</i> |
| China rockfish | <i>Sebastes nebulosus</i> | pink shrimp (or northern shrimp) | <i>Pandalus eous</i> |
| tiger rockfish | <i>Sebastes nigrocinctus</i> | yellowleg pandalid | <i>Pandalus tridens</i> |
| northern rockfish | <i>Sebastes polyspinis</i> | spot shrimp | <i>Pandalus platyceros</i> |
| redstripe rockfish | <i>Sebastes proriger</i> | humpy shrimp | <i>Pandalus goniurus</i> |
| yelloweye rockfish | <i>Sebastes ruberrimus</i> | coonstripe shrimp | <i>Pandalus hypsinotus</i> |
| redbanded rockfish | <i>Sebastes babcocki</i> | roughpatch shrimp | <i>Pandalus stenolepis</i> |
| harlequin rockfish | <i>Sebastes variegatus</i> | sidestripe shrimp | <i>Pandalopsis dispar</i> |
| sharpchin rockfish | <i>Sebastes zacentrus</i> | <i>Eualus</i> sp. | <i>Eualus</i> sp. |
| <u>Jellyfish</u> | | barbed eualid | <i>Eualus barbatus</i> |
| jellyfish unident. | Schizophzoa | bigeye eualid | <i>Eualus macrophthalmus</i> |
| <i>Chrysaora melanaster</i> | <i>Chrysaora melanaster</i> | shortscale eualid | <i>Eualus suckleyi</i> |
| <i>Aequorea</i> sp. | <i>Aequorea</i> sp. | candy stripe shrimp | <i>Lebbeus grandimana</i> |
| <i>Aurelia</i> sp. | <i>Aurelia</i> sp. | spiny lebbeid | <i>Lebbeus groenlandicus</i> |
| <i>Cyanea</i> sp. | <i>Cyanea</i> sp. | common crangon | <i>Crangon communis</i> |
| Ctenophore unident. | Ctenophora | ridged crangon | <i>Crangon dalli</i> |
| <i>Beroe</i> sp. | <i>Beroe</i> sp. | Arctic argid | <i>Argis dentata</i> |
| gorgonian coral unident. | Gorgonacea | <i>Sclerocrangon</i> sp. | <i>Sclerocrangon</i> sp. |
| Kamchatka coral | <i>Paragorgia arborea</i> | Pacific glass shrimp | <i>Pasiphaea pacifica</i> |
| orange sea pen | <i>Ptilosarcus gurneyi</i> | <u>Crab</u> | |
| sea whip unident. | Virgulariidae | Dungeness crab | <i>Metacarcinus magister</i> |
| <u>Sea Anemone</u> | | pygmy cancer crab | <i>Cancer oregonensis</i> |
| sea anemone unident. | Actinaria | pea crab | <i>Pinnixa occidentalis</i> |
| <u>Worms</u> | | graceful decorator crab | <i>Oregonia gracilis</i> |
| polychaete worm unident. | Polychaeta | Tanner crab | <i>Chionoecetes bairdi</i> |
| worm unident. | | Pacific lyre crab | <i>Hyas lyratus</i> |
| tube worm unident. | | helmet crab | <i>Telmessus cheiragonus</i> |
| sea mouse unident. | Aphroditidae | hermit crab unident. | Paguridae |
| scale worm unident. | <i>Eunoe</i> sp. | box crab | <i>Lopholithodes foraminatus</i> |

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Table 3.–Page 4 of 5.

| Common Name | Scientific Name | Common Name | Scientific Name |
|--------------------------------------|------------------------------------|-----------------------------------|----------------------------------|
| <u>Crab (continued)</u> | | <u>Bivalves</u> | |
| golden king crab | <i>Lithodes aequispinus</i> | bivalve unident. | Bivalvia |
| rhinoceros crab | <i>Rhinolithodes wosnessenskii</i> | mussel unident. | Mytilidae |
| red king crab | <i>Paralithodes camtschaticus</i> | <u>Scallops</u> | |
| scaled crab | <i>Placetron wosnessenskii</i> | <i>Chlamys</i> sp. (bay scallop) | <i>Chlamys</i> sp. |
| hair crab | <i>Erimacrus isenbeckii</i> | weathervane scallop | <i>Patinopecten caurinus</i> |
| hyas unident. | <i>Hyas</i> sp. | cockle unident. | |
| kelp crab unident. | <i>Pugettia</i> sp. | smoothcockle (formerly Greenland) | <i>Serripes</i> sp. |
| <u>Chitons</u> | | Alaska falsejingle | <i>Pododesmus macrochisma</i> |
| chiton unident. | Polyplacophora | <u>Cephalopods</u> | |
| giant Pacific chiton (gumboot) | <i>Cryptochiton stelleri</i> | giant octopus | <i>Octopus dofleini</i> |
| <u>Snails</u> | | eastern Pacific bobtail | <i>Rossia pacifica</i> |
| snail eggs | gastropod eggs | magistrate armhook squid | <i>Berryteuthis magister</i> |
| nudibranch unident. | Nudibranchia | juvenile armhook squid | <i>Berryteuthis magister</i> |
| moon snail | <i>Cryptonatica</i> sp. | <u>Sea Stars</u> | |
| frilled dogwinkle | <i>Nucella lamellosa</i> | mottled sea star | <i>Evasterias troschelii</i> |
| <i>Colus</i> sp. | <i>Colus</i> sp. | giant sea star | <i>Evasterias echinosoma</i> |
| left-hand whelk | <i>Pyrulofusus harpa</i> | redbanded sea star | <i>Orthasterias koehleri</i> |
| volute whelk | <i>Volutopsius castanea</i> | sunflower sea star | <i>Pycnopodia helianthoides</i> |
| Kennicott's beringius | <i>Beringius kennicottii</i> | long-rayed star | <i>Stylasterias forreri</i> |
| thick-cord whelk | <i>Beringius crebricostatus</i> | blackspined sea star | <i>Lethasterias nanimensis</i> |
| <i>Beringius undatus</i> | <i>Beringius undatus</i> | <i>Henricia</i> sp. | <i>Henricia</i> sp. |
| <i>Neptunea</i> sp. | <i>Neptunea</i> sp. | Leptasterias sp. | <i>Leptasterias</i> sp. |
| Pribilof neptune (or Pribilof whelk) | <i>Neptunea pribiloffensis</i> | Swift's sea star | <i>Gephyreaster swifti</i> |
| ribbed neptune | <i>Neptunea lyrata</i> | <i>Pseudarchaster parelii</i> | <i>Pseudarchaster parelii</i> |
| keeled aforia | <i>Aforia circinata</i> | <i>Pseudarchaster alascensis</i> | <i>Pseudarchaster alascensis</i> |
| hairy triton (or Oregon triton) | <i>Fusitriton oregonensis</i> | CA spiny star | <i>Hippasteria californica</i> |
| <i>Buccinum</i> sp. | <i>Buccinum</i> sp. | Spiny red sea star | <i>Hippasteria spinosa</i> |
| sinuous whelk | <i>Buccinum plectrum</i> | vermillion sea star | <i>Mediaster aequalis</i> |
| silky buccinum (or ladder whelk) | <i>Buccinum scalariforme</i> | red bat (cookie) star | <i>Ceramaster japonicus</i> |
| Alaska volute (or Stearn's volute) | <i>Arctomelon stearnsii</i> | orange bat (cookie) star | <i>Ceramaster patagonicus</i> |

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Table 3.–Page 5 of 5.

| Common Name | Scientific Name | Common Name | Scientific Name |
|----------------------------------|--|------------------------|--|
| <u>Sea Stars (continued)</u> | | <u>Sea Cucumbers</u> | |
| arctic bat (cookie) star | <i>Ceramaster arcticus</i> | red (CA) sea cucumber | <i>Parastichopus californicus</i> |
| sand star | <i>Luidia foliolata</i> | sweet sea potato | <i>Molpadia intermedia</i> |
| leather sea star | <i>Dermasterias imbricata</i> | crescent sea cucumber | <i>16essellated16.</i> |
| <i>Solaster</i> sp. | <i>Solaster</i> sp. | <i>Bathyplores</i> sp. | <i>Bathyplores</i> sp. |
| Striped sun sea star | <i>Solaster stimpsoni</i> | sea football | <i>Cucumaria fallax</i> |
| rose sea star | <i>Crossaster papposus</i> | sponge unident. | Porifera |
| slime star unident. | <i>Pteraster</i> sp. | Flatworm unident. | Platyhelminthes |
| 16essellated slime star | <i>Pteraster tessellatus</i> | peanutworm unident. | Echiura |
| pincushion sea star | <i>Diplopteraster multipes</i> | bryozoan unident. | Bryozoa |
| purple-orange sea star | <i>Asterias amurensis</i> | lampshell unident. | Brachiopoda |
| common mud star (ninja) | <i>Ctenodiscus crispatus</i> | <u>Tunicates</u> | |
| Northern sand star | <i>Dipsacaster borealis</i> | tunicate unident. | Ascidacea |
| Fragile star | <i>Cheiraster dawsoni</i> | sea potato | <i>Styela rustica</i> |
| <u>Sea Urchins</u> | | bristly tunicate | <i>Halocynthia (hilgendorfi) igaboja</i> |
| green sea urchin | <i>Strongylocentrotus droebachiensis</i> | sea peach | <i>Halocynthia aurantium</i> |
| red sea urchin | <i>Strongylocentrotus franciscanus</i> | sea blob | <i>Synoicum</i> sp. |
| Orange-pink (fragile) sea urchin | <i>Alloccentrotus fragilis</i> | | |
| heart urchin | <i>Brisaster latifrons</i> | | |
| sand dollar unident. | Clypeasteroidea | | |
| brittle star unident. | Ophiuridae | | |
| basket star | <i>Gorgonocephalus eucnemis</i> | | |

Table 4.–Species collection list of rarely encountered organisms on small-mesh trawl survey.

| Common name ^a | Species | Common name ^b | Species |
|--------------------------|--------------------------------|--------------------------|--------------------------------------|
| northern ronquil | <i>Ronquilus jordani</i> | Redstripe rockfish | <i>Sebaster proriger</i> |
| <i>Eunophrys</i> sp. | <i>Eunophrys</i> sp. | Bocaccio | <i>Sebastes paucispinis</i> |
| pink salmon | <i>Onchorhynchus gorbuscha</i> | Brown Irish lord | <i>Hemilepidotus spinosus</i> |
| gorgonian coral | Gorgonacea | Longfin Irish lord | <i>Hemilepidotus zapus</i> |
| tube worm | | Butterfly sculpin | <i>Hemilepidotus papilio</i> |
| Alaska false jingle | <i>Pododesmus macrochisma</i> | Fourhorn sculpin | <i>Myoxocephalus quadricornis</i> |
| sea potato | <i>Styela rustica</i> | Arctic sculpin | <i>Myoxocephalus scorpioides</i> |
| sea blob | <i>Synoicum</i> sp. | Warthead sculpin | <i>Myoxocephalus niger</i> |
| dock shrimp | <i>Pandalus danae</i> | Frog sculpin | <i>Myoxocephalus stelleri</i> |
| bigeye eualid | <i>Eualus macrophthalmus</i> | Small-mouth ronquil | <i>Bathymaster leurolepis</i> |
| golden king crab | <i>Lithodes aequispinus</i> | Polar eelpout | <i>Lycodes polaris</i> |
| silky buccinum | <i>Buccinum scalariforme</i> | Marbled eelpout | <i>Lycodes ravidens</i> |
| <i>Leptasterias</i> sp. | <i>Leptasterias</i> sp. | Black eelpout | <i>Lycodes diapterus</i> |
| red bat star | <i>Ceramaster japonicus</i> | Ebony eelpout | <i>Lycodes concolor</i> |
| orange bat star | <i>Ceramaster arcticus</i> | Twoline eelpout | <i>Bothrocara brunneum</i> |
| Northern sand star | <i>Dipsacaster borealis</i> | Pallid eelpout | <i>Lycodapus mandibularis</i> |
| Bubble jelly | <i>Aequorea</i> sp. | Bering flounder | <i>Hippoglossoides robustus</i> |
| Lion's mane jelly | <i>Cyanea</i> sp. | Giant rock scallop | <i>Crassadoma gigantes</i> |
| | | Spiny scallop | <i>Chlamys hastate</i> |
| | | Island scallop | <i>Chlamys islandica</i> |
| | | Flat-tip piddock | <i>Penitella penita</i> |
| | | Chimney piddock | <i>Penitella penita</i> |
| | | Setose hermit crab | <i>Pagurus setosus</i> |
| | | Bluespined hermit crab | <i>Pagurus kennerlyi</i> |
| | | Pribilof hermit crab | <i>Pagurus undosus</i> |
| | | Long-hand hermit crab | <i>Pagurus tanneri</i> |
| | | Horny-hand hermit crab | <i>Pagurus cornutus</i> |
| | | Northern sun star | <i>Solaster endeca</i> |
| | | Morning sun star | <i>Solaster dawsoni</i> |
| | | Evening sun star | <i>Solaster paxillatus</i> |
| | | Grooved sun star | <i>Crossaster borealis</i> |
| | | Greenland sea star | <i>Leptasterias groenlandica</i> |
| | | Sheathed sea star | <i>Leptasterias stolocantha</i> |
| | | Knobless 6-rayed star | <i>Leptasterias hexactis</i> |
| | | White sea urchin | <i>Strongylocentrotus pallidus</i> |
| | | Purple urchin | <i>Strongylocentrotus purpuratus</i> |

^a These organisms on the small-mesh species list are always identified.

^b These organisms are not required to be identified to species, but if positive ID is made are photographed and collected.

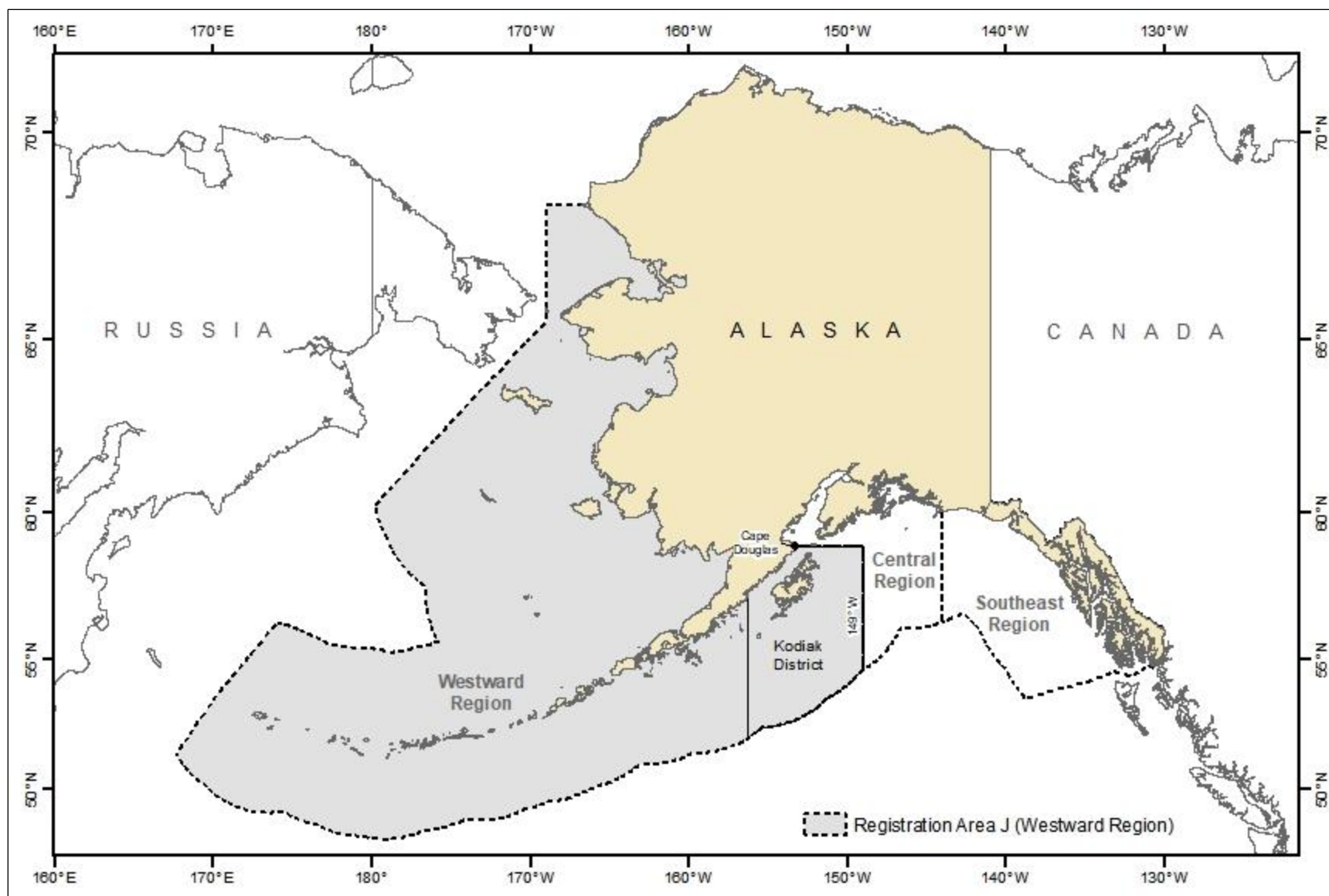


Figure 1.—Kodiak shrimp management District in Registration Area J.

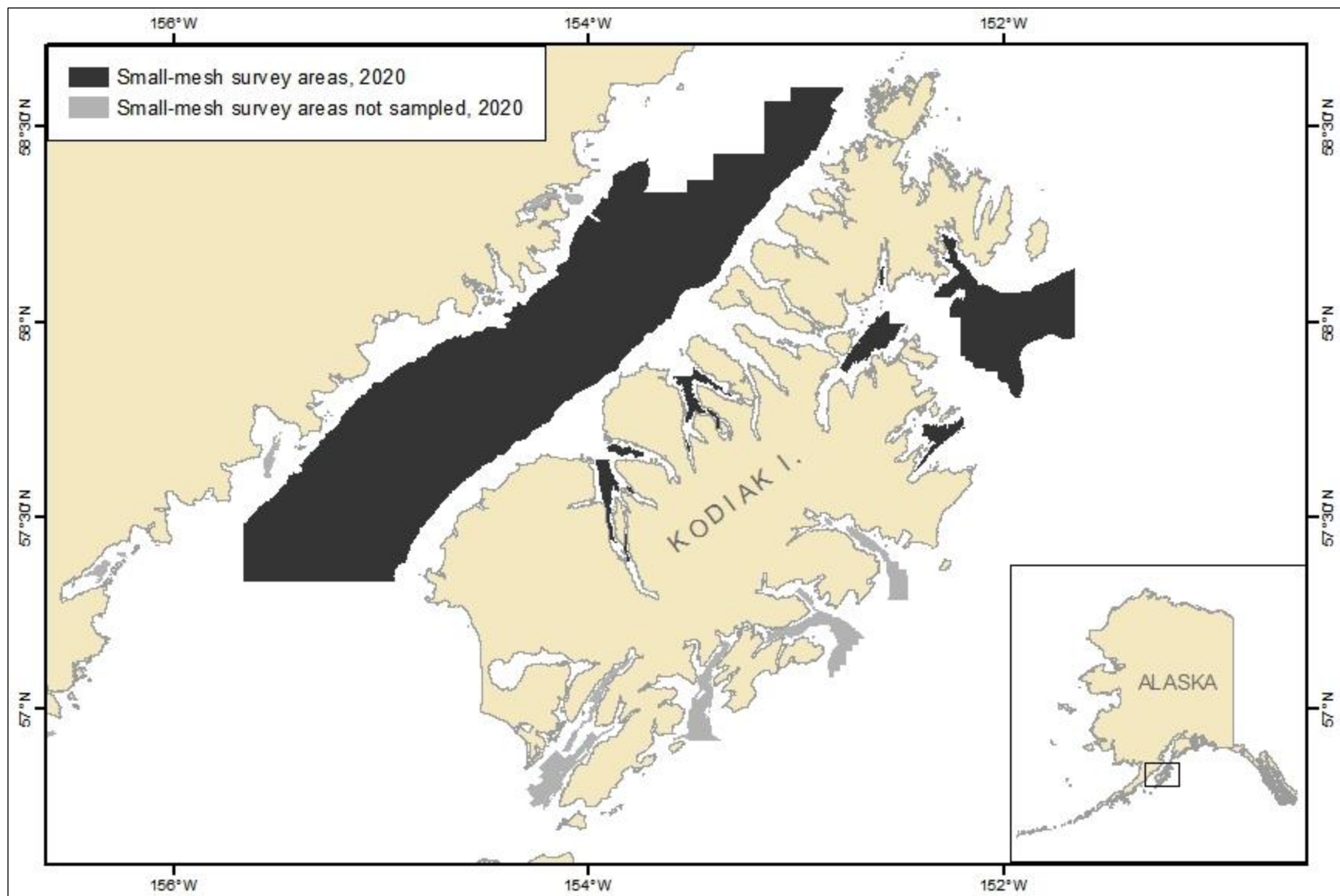


Figure 2.—Kodiak shrimp District small-mesh bottom trawl survey areas.



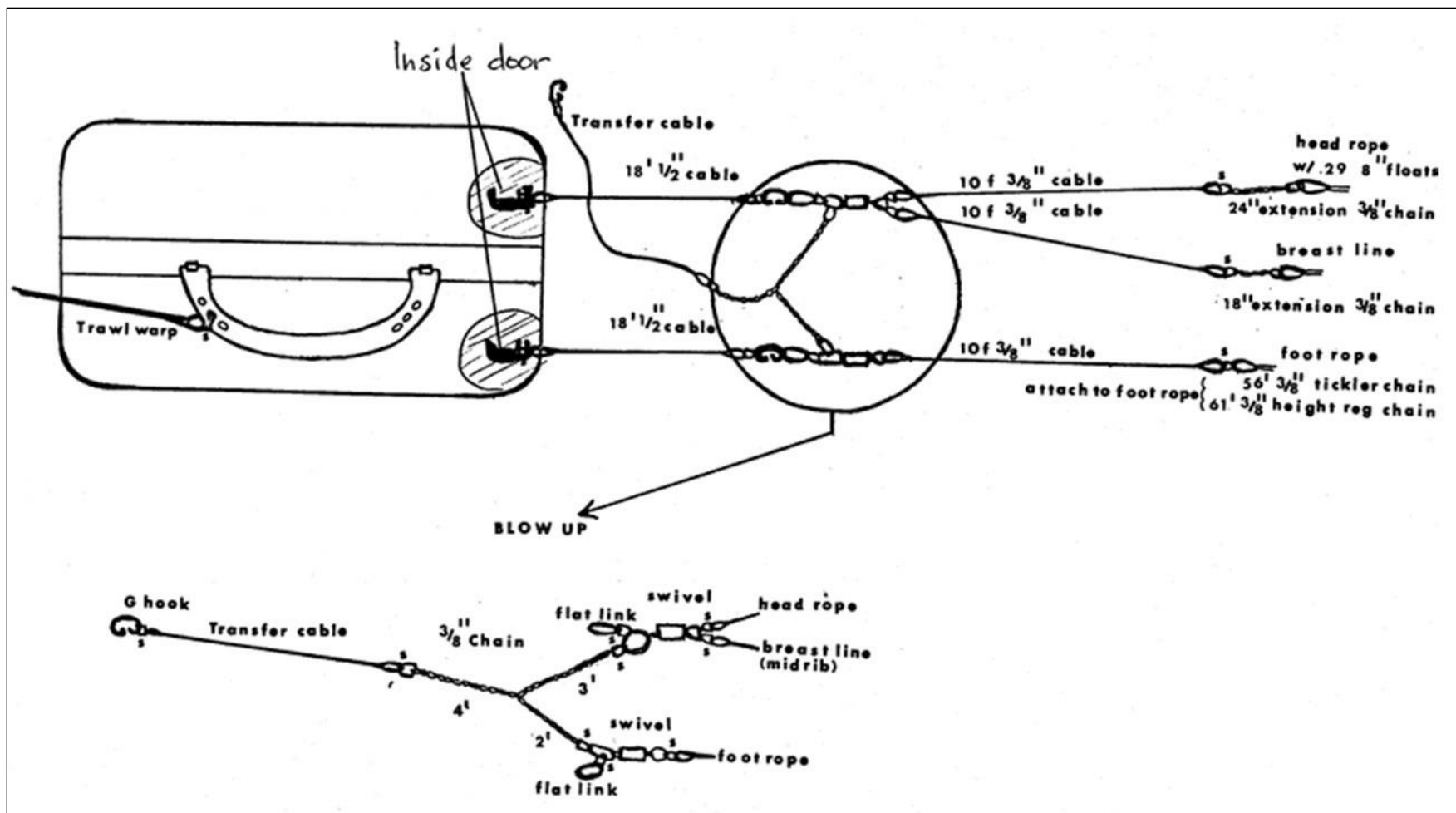
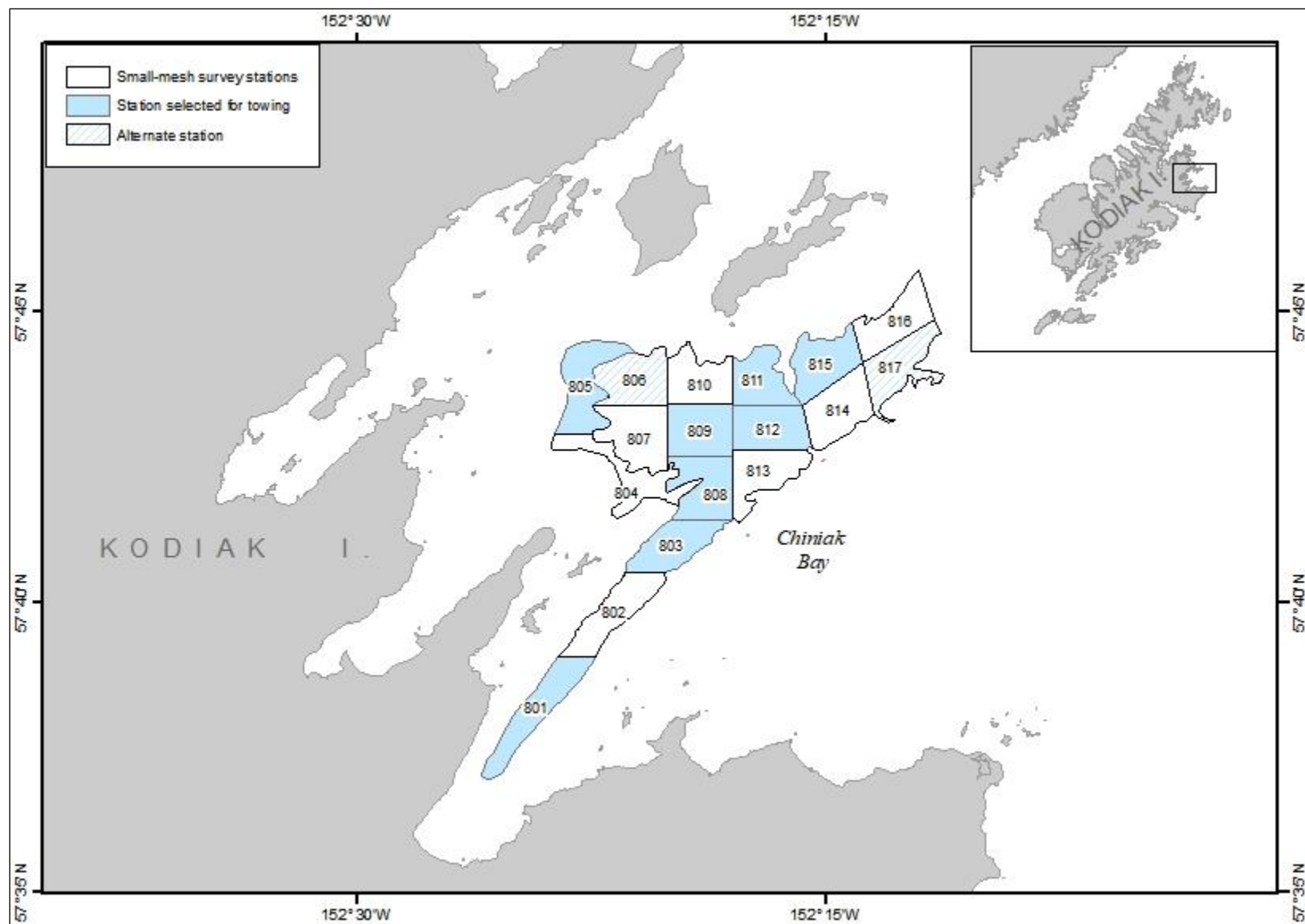


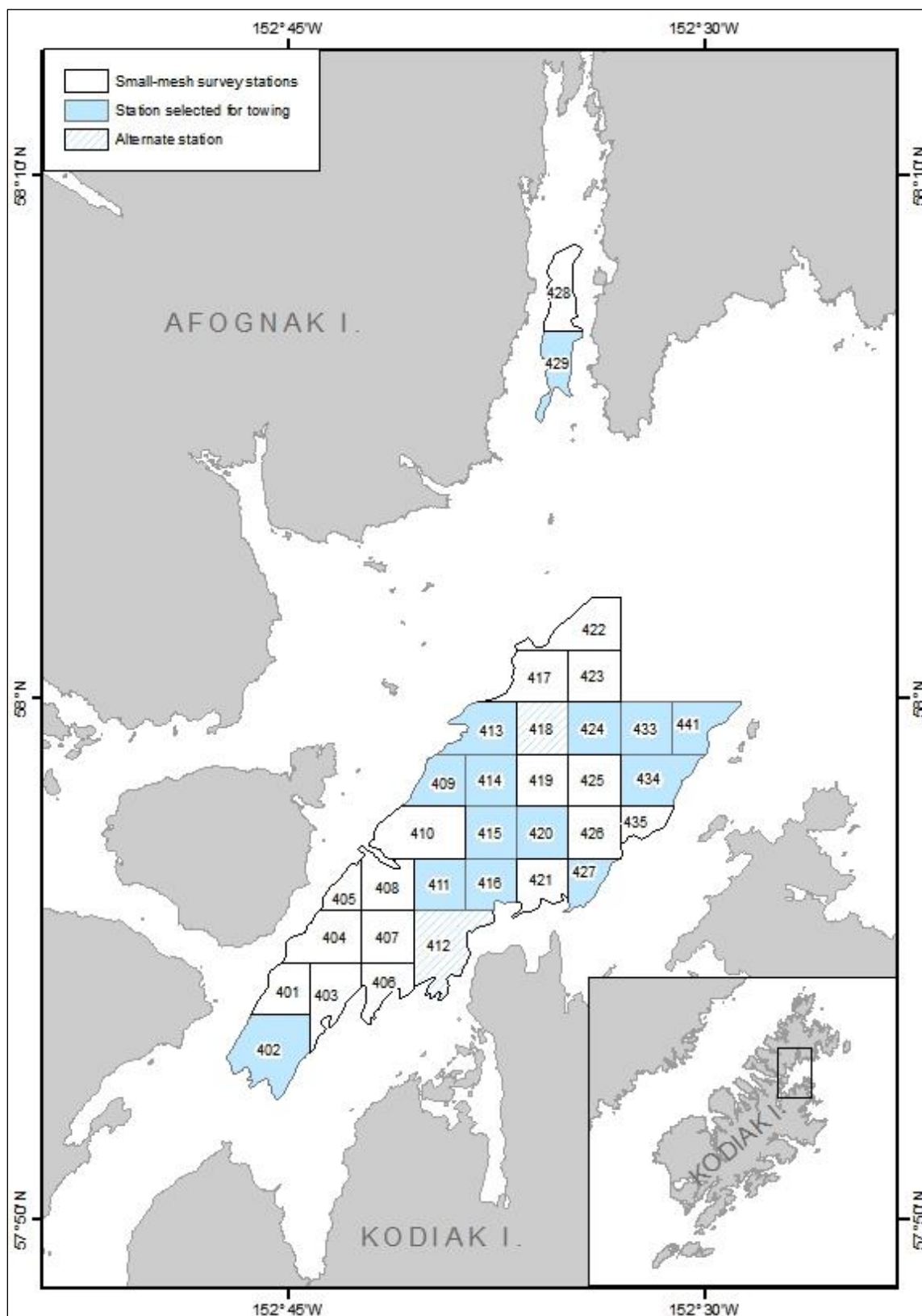
Figure 4.—Rigging for the 61-foot ADF&G small-mesh research trawl.

APPENDIX A. SMALL-MESH TRAWL SURVEY STATION MAPS

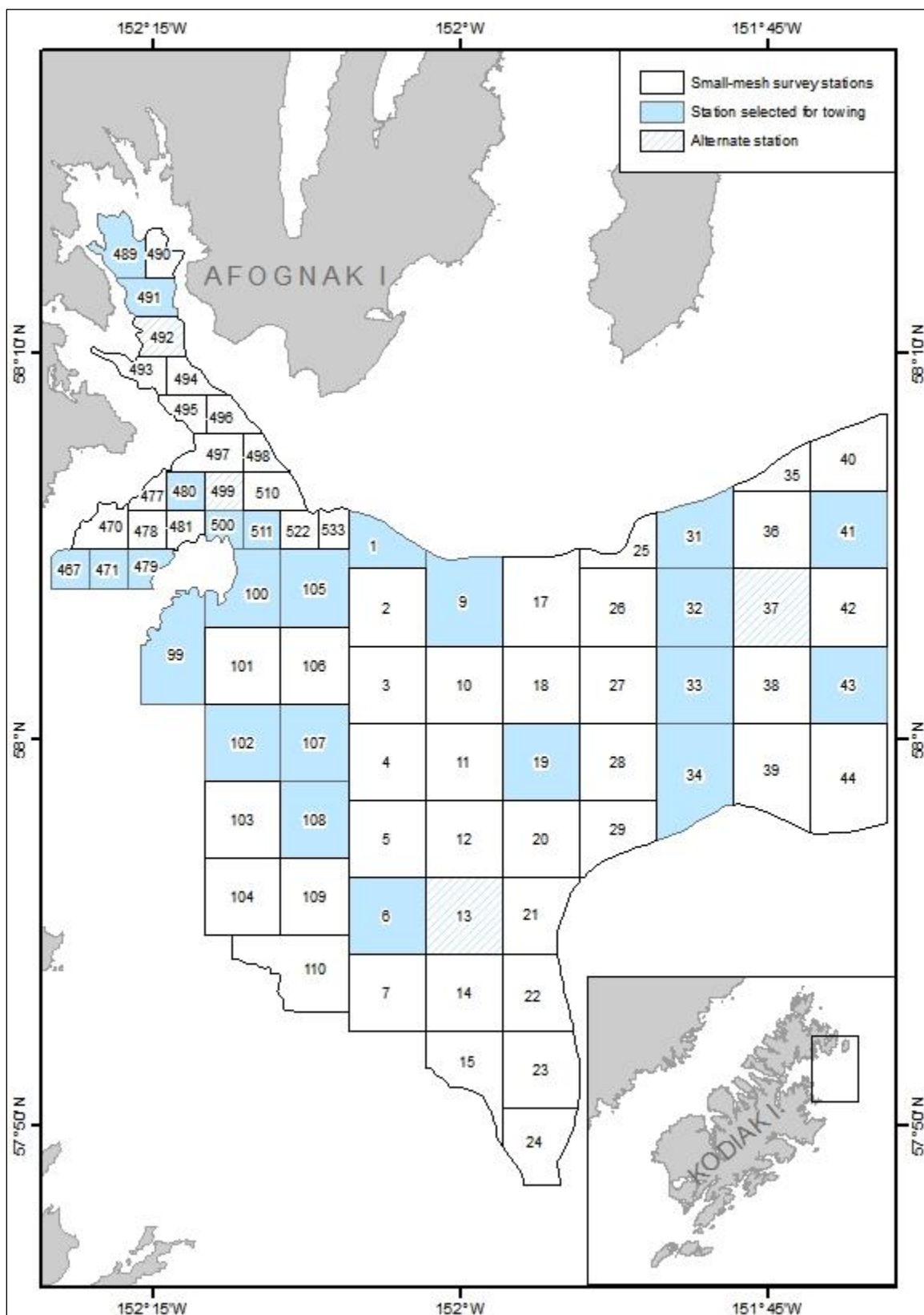
Appendix A1.—Station boundaries and names, Chiniak Bay, 2020 Kodiak District small-mesh trawl survey.



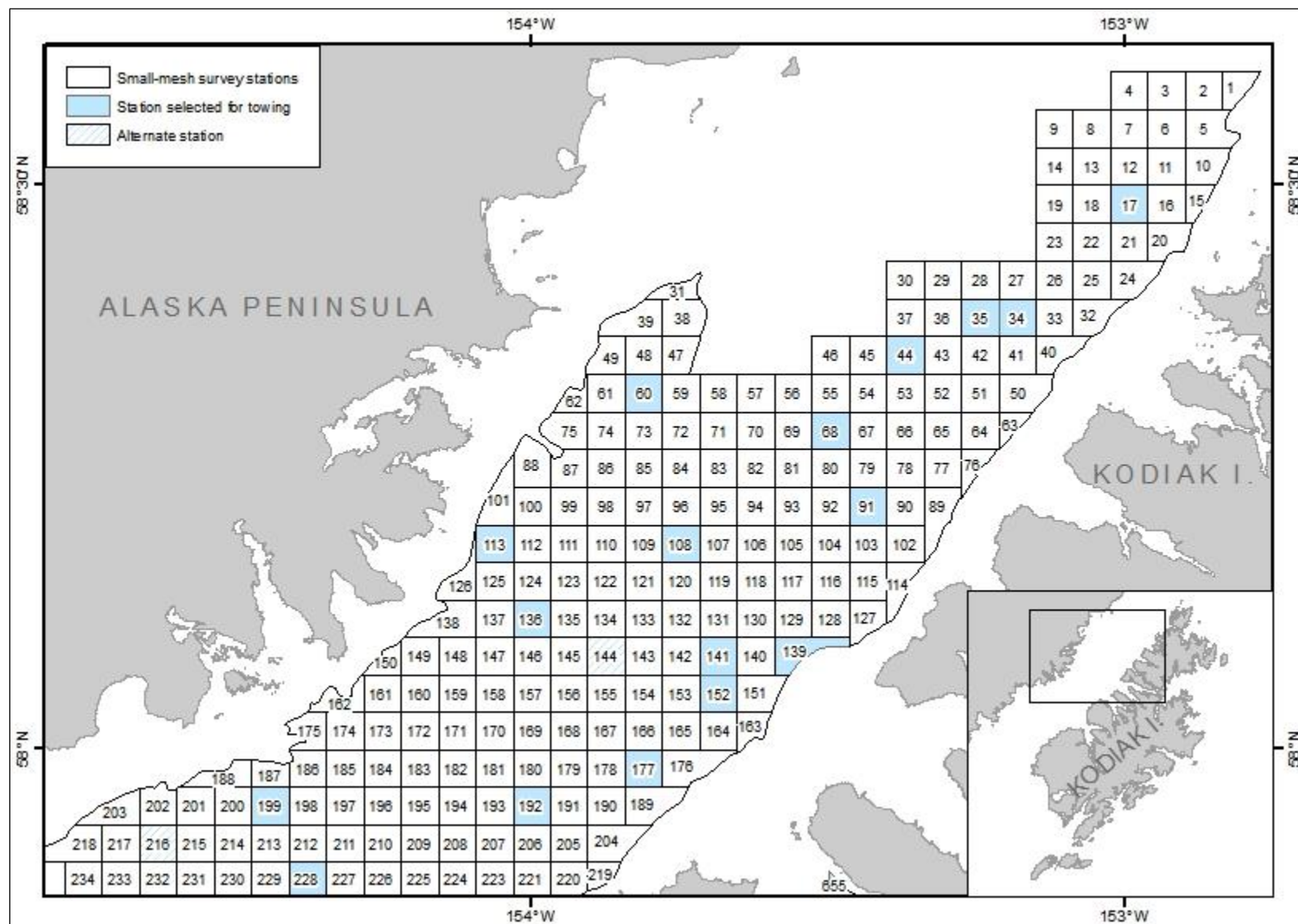
Appendix A2.—Station boundaries and names, Kazakof and Kizhuyak bays, 2020 Kodiak District small-mesh trawl survey.



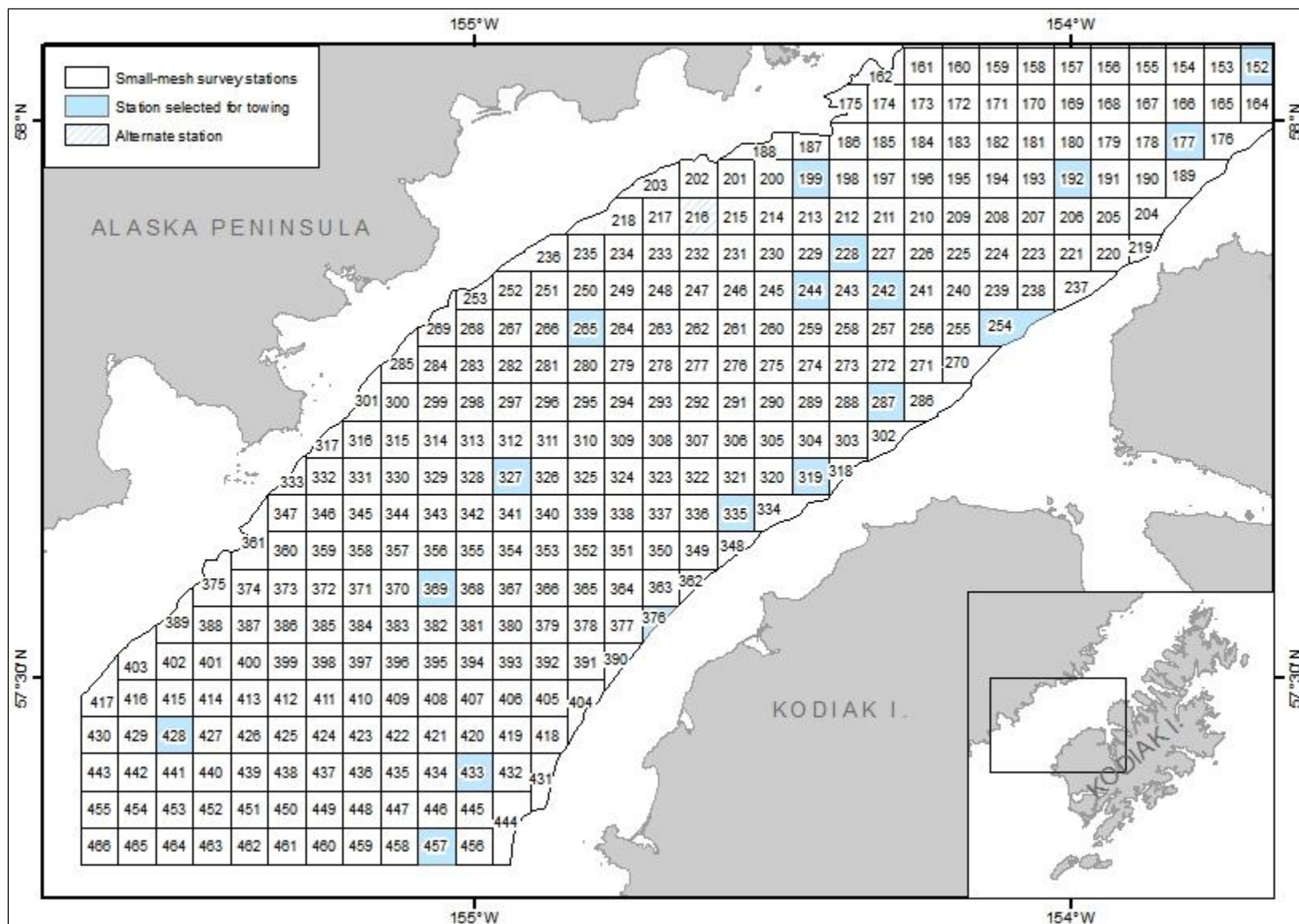
Appendix A3—Station boundaries and names, Izhut and Marmot bays, 2020 Kodiak District small-mesh trawl survey.



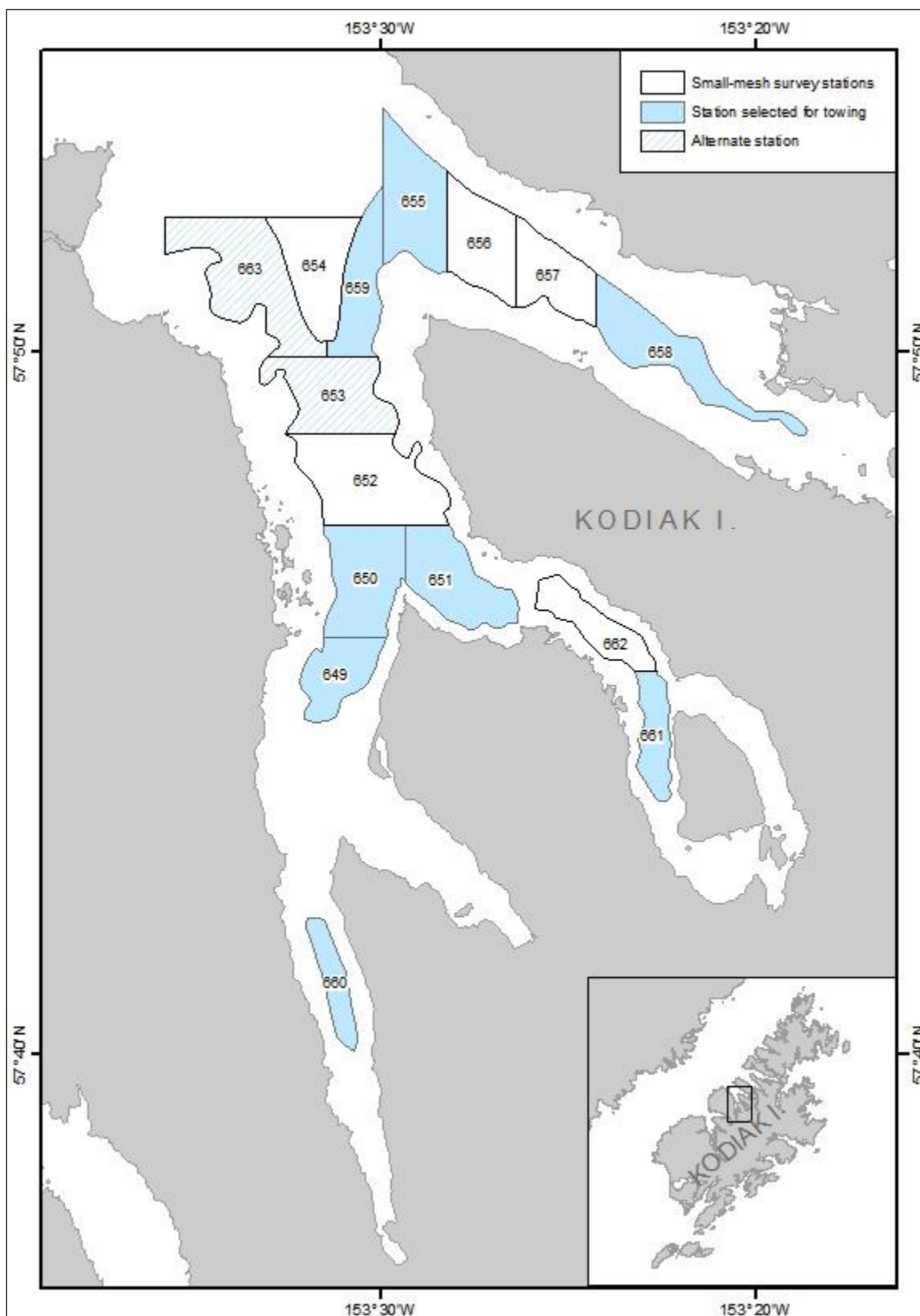
Appendix A4.—Station boundaries and names, northern Shelikof Strait, 2020 Kodiak District small-mesh trawl survey.



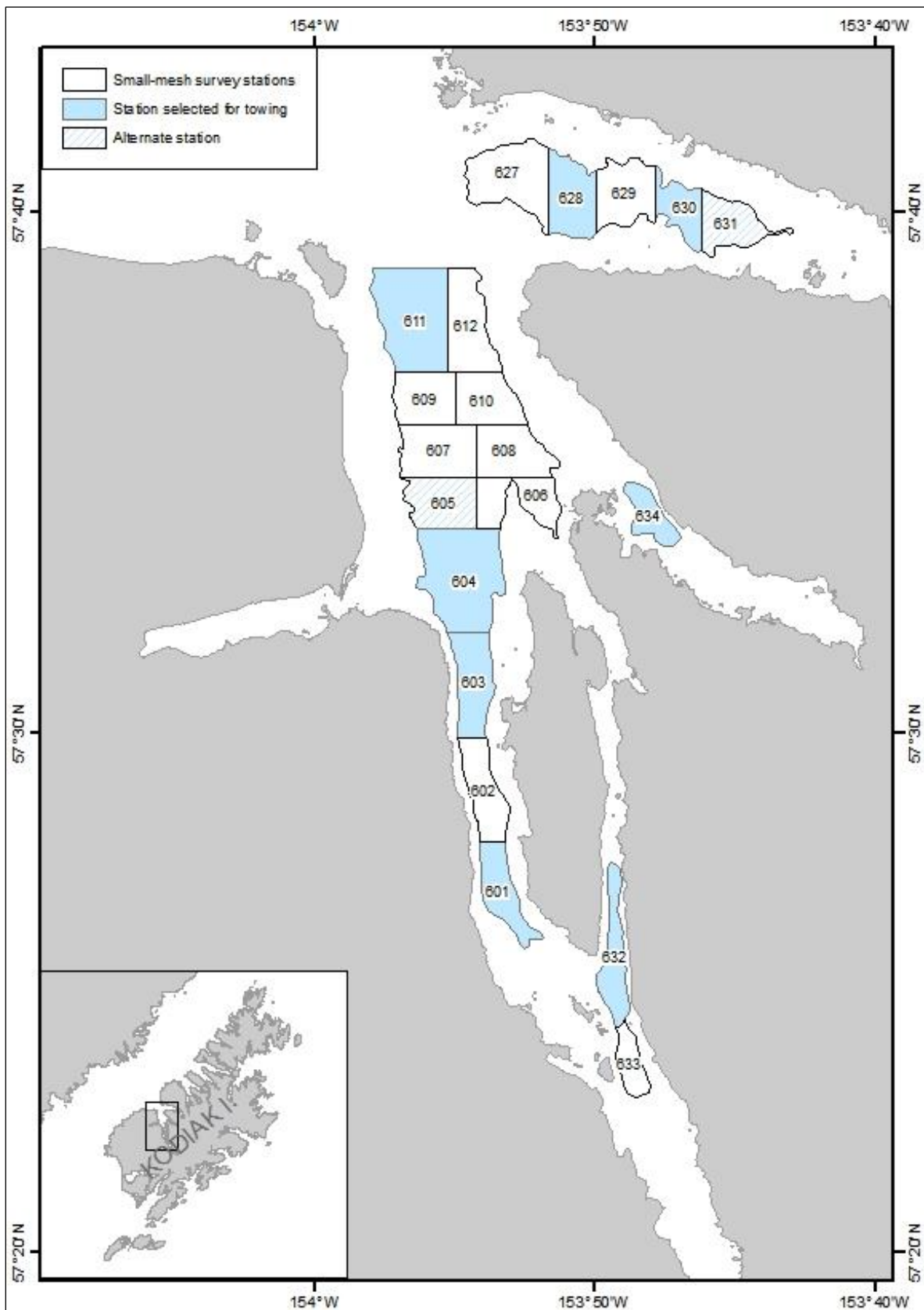
Appendix A5.—Station boundaries and names, southern Shelikof Strait, 2020 Kodiak District small-mesh trawl survey.



Appendix A6.—Station boundaries and names, Uganik Bay, 2020 Kodiak District small-mesh trawl survey.



Appendix A7.—Station boundaries and names, Uyak Bay, 2020 Kodiak District small-mesh trawl survey.



APPENDIX B. FORMS

Appendix B1.—Skipper trawl record form.



ALASKA DEPARTMENT OF FISH AND GAME
2020 SHRIMP TRAWL SURVEY
SKIPPER TRAWL RECORD

Denis Cox Jr.

Skipper's Name

Survey Area

| | | | | | | | | | | | | |
|---------------|---|-------------|---|--------|-------------|---------|--------------|-------------|------|-------|-----|------|
| Cruise Number | | Haul Number | | Region | Survey Area | Stratum | Station Name | Vessel Code | Date | | | |
| 2 | 0 | 0 | 2 | | | | | 3 | 0 | month | day | year |
| | | | | 1 | | | | | | | | 2 |
| | | | | | | | | | | | | 0 |

| | | | | | |
|--------------------------------|-----------|-------------------------------|------------|-----|----------------|
| (1) Starting Position | | Compass Heading (magnetic) | Trawl Time | | Dist- Towed |
| Latitude | Longitude | | Start | End | |
| 5 | 1 | | | | |
| degrees / mins / decimal mins. | | | | | (nm) |

| | | |
|------------------------|---|----------------------|
| (2) Haul Back Position | | Elapsed (minutes) |
| 5 | 1 | |
| Position X | | Position Y |

| | | | | | | | | |
|-----------------|---------|------|---------|------|-------|--------------------|---------------|----------------------|
| Depth (fathoms) | | | Weather | | | Scope (fathoms) | Gear Perf. | Bottom Temp. (°C) |
| Maximum | Minimum | Avg. | Cloud | Wind | Swell | | | |
| | | | | | | | | |

Skipper's Comments (gear problems, snags, weather, tides, etc.):

Marine Mammal Observations:

Were marine mammals seen? ☐ 15 minutes prior ☐ Deployment ☐ Fishing ☐ Retrieval

How Many? _____ What Species? _____ How far away? _____

What were they doing?

Was action taken? (Wait, Move on)

| | | | | | |
|---------------------|------|---|------|--------------|------|
| Cloud Cover | Code | Wind Speed (Beaufort Scale) | Code | Swell (feet) | Code |
| Clear | 1 | Calm; sea surface smooth and mirror like | 0 | 0 - 2 | 1 |
| 1/8 obscured | 2 | Light air; scaly ripples, no foam crests | 1 | 2 - 4 | 2 |
| 1/4 obscured | 3 | Light breeze; small wavelets, crests glassy, not breaking | 2 | 4 - 6 | 3 |
| 3/8 obscured | 4 | Gentle breeze; large wavelets, crests begin to break, scattered whitecaps | 3 | 6 - 8 | 4 |
| 1/2 obscured | 5 | Moderate breeze; waves 1-4 ft becoming longer, numerous whitecaps | 4 | 8 - 10 | 5 |
| 5/8 obscured | 6 | Fresh breeze; waves 4-8 ft, longer form, many whitecaps, some spray | 5 | 10 - 12 | 6 |
| 3/4 obscured | 7 | Strong breeze; waves 8-13 ft, whitecaps common, more spray | 6 | 12 - 14 | 7 |
| 7/8 obscured | 8 | Near gale; sea heaps up, waves 13-20 ft, foam streaks off breakers | 7 | 14 - 16 | 8 |
| Completely overcast | 9 | Gale; waves 13-20 ft, greater length, crest edges break, foam streaks | 8 | Over 16 | 9 |
| | | Strong gale; waves 20 ft, sea rolls, dense foam streaks, spray | 9 | | |

| | | | |
|---|------|---|------|
| Gear Performance | Code | Gear Performance | Code |
| Good performance | 0 | Unsatisfactory ; ripped net | 7 |
| Satisfactory ; unspecified minor problems | 1 | Unsatisfactory ; net off bottom for part/all of tow | 8 |
| Satisfactory ; minor hangup or rip | 2 | Unsatisfactory ; caught crab pot | 9 |
| Satisfactory ; net off bottom for short part of tow | 3 | Unsatisfactory ; unable to reach bottom due to currents | 10 |
| Satisfactory ; caught crab pot | 4 | Unsatisfactory ; net not properly configured | 11 |
| Unsatisfactory ; unspecified problem | 5 | Unsatisfactory ; crossed doors | 12 |
| Unsatisfactory ; net hung up | 6 | Unsatisfactory ; net mudded down | 13 |

Data Entry Initials: _____

-continued-

Skipper Trawl Record Instructions

This form records each haul: area, date, position, time trawled, depth, length of tow, gear performance, and weather conditions.

| | | |
|-----------------------------------|---|----------------------|
| Cruise Number | Last 2 digits of year followed by sequential cruise number. The large-mesh survey is the first trawl survey of the season, so in 2020 the cruise number is “2001” | |
| Haul Number | Beginning with 1, each haul is numbered sequentially through each cruise regardless of gear performance. | |
| Region | Kodiak = 1 | |
| Survey area | Inner Marmot = 02 | Outer Marmot = 03 |
| | Chiniak Bay = 04 | Uyak Bay = 10 |
| | Uganik Bay = 12 | Shelikof Strait = 25 |
| Stratum | not used | |
| Station Number | Consult charts or operational plan for station name | |
| Vessel Code | Code for vessel conducting survey. Prefilled with “30”=Resolution | |
| Date | Month/day/year | |
| Starting Position | | |
| <i>Latitude, Longitude</i> | degrees/minutes/decimal minutes where trawl net reaches bottom | |
| Compass Heading | Direction of tow according to magnetic compass | |
| Trawl time | | |
| <i>Start</i> | Time trawl net reaches bottom, use 24-hour clock | |
| <i>End</i> | Time trawl net retrieval begins, use 24-hour clock | |
| Dist- Towed | Length of the haul in nautical miles, determined by skipper | |
| Haul Back Position | | |
| <i>Latitude, Longitude</i> | degrees/minutes/decimal minutes where trawl net retrieval begins | |
| Elapsed | Amount of time in minutes net was fishing | |
| Depth | | |
| <i>Maximum</i> | Maximum depth of haul in fathoms | |
| <i>Minimum</i> | Minimum depth of haul in fathoms | |
| <i>Avg.</i> | Average depth of haul in fathoms, determined by skipper | |
| Weather | | |
| <i>Cloud, Wind, Swell</i> | Use criteria on data sheet | |
| Scope | Fathoms of trawl wire deployed | |
| Gear Perf. | Use <i>Gear Performance</i> codes on skipper trawl record form. Written explanation should accompany problem tows. | |
| Bottom Temp. | Not entered on skipper form. Recorded in database upon download of temperature logger data attached to net. | |
| Marine Mammal Observations | In lieu of a marine mammal observer stationed in the wheelhouse, the skipper should be vigilant and record observations of marine mammals from 15 minutes prior to net deployment to net retrieval. | |
| Initials | Initials of person entering data into the database. | |

Appendix B2.-On-deck sampling form – Species composition.

| ON DECK SAMPLING FORM - SPECIES COMPOSITION | | | | | |
|---|---------------------|------------------|---------------------------------|----------------------------------|----------------------|
| Haul _____ | Vessel _____ | Resolution _____ | Cruise _____ | 2002 | Total Wt. _____ |
| Date _____ | Location _____ | | | | Bag (tare) Wt. _____ |
| Recorder's Name _____ | | | | Whole-hauled debris weight _____ | |
| Species Name | 100% | Measured Weights | Unmeasured Weights (DUMPERS) | Count of unmeasured: | |
| | ✓ | | | weighed | unweighed |
| Halibut | | | | | |
| ♀ | | | | | |
| ♀ | | | | | |
| ♀ | | | | | |
| ♀ | | | | | |
| | | | | | |
| | | | | | |
| Arrowtooth | | | | | |
| Flathead | | | | | |
| Pollock | Y or N | | | | |
| | | | | | |
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| | | | | | |
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| | | | | | |
| | | | | | |
| | | | | | |
| Were all shrimp on table sorted? Y or N | | | | | |
| Total unsorted shrimp weight from table | Shrimp Species Name | Sorted Count | Sorted Weight | Measured Weight | |
| | Pink Shrimp | | | | |
| | Sidestripe Shrimp | | | | |
| | <i>C. communis</i> | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Species/Sex count: _____ 100% count: _____ *Halibut and Skate entries are lengths!!

Page _____ of _____. Initial here after data has been entered: ○

-continued-

On-deck Sampling Form - Species Composition Instructions

Header Information:

Haul Sequential number for current haul
Date Date of current haul
Recorder's Name Last name of person recording data on the form
Vessel Name of vessel conducting survey – prefilled with “Resolution”
Location Nearest bay, headland, or gully
Cruise Last 2 digits of the year followed by sequential cruise number. The large-mesh survey is the first trawl survey of the season, so in 2016 the cruise is “1601”.

Total Wt. Weight of catch and codend before it is emptied into sorting bin.

Bag (tare) Wt. Weight of empty codend after catch is emptied. This weight differs depending on where on the net the crane lifts from.

Whole-hauled debris weight Weight of large debris items such as crab pots, buckets, rocks, logs, etc. that are in the codend.

Data fields:

Species Name List species name, common or scientific, for each species in the haul. List males and females separately if sexed. Some of the most common species are prefilled.

100% Check this column for all species/sexes that are whole-haul sampled. Circle “Y” or “N” for the prefilled “Pollock” row. If Tanner crab are subsampled specify “No” in this column.

Measured Weights Enter weights of all baskets/totes of measured animals. Halibut and skates do not get weighed, instead record all lengths on this form.

Unmeasured Weights (DUMPERS) Enter weights of all baskets/totes of animals that are not measured.

Count of unmeasured: weighed Enter number of individuals that have been weighed, but not measured. All animals, if possible, are to be enumerated if not measured.

Count of unmeasured: unweighed Enter number of individuals not weighed or measured. This only applies to species such as pollock or Pacific cod that are counted over the vessel from the sorting bins.

Shrimp Specific Section: This data is used to properly account for the composition of shrimp in the subsample, depending on sampling method.

Were all shrimp on table sorted? Circle “Y” or “N” depending on sampling method.

| | |
|--|--|
| Total unsorted shrimp weight from table | Enter weights of all baskets of shrimp from the subsample that did not get speciated. |
| Shrimp Species Name | List species name, common or scientific, for each shrimp species in the haul. Some of the most common shrimp species are prefilled. |
| Sorted Count | Enter number of individuals that have been weighed. All speciated shrimp, if possible, are to be enumerated if not measured. |
| Sorted Weight | Enter weights of all speciated shrimp from the subsample. |
| Measured Weight | Enter the weight of ONLY the measured portion of shrimp. This must be done AFTER measuring is completed and is used for an average weight. |
| <i>Footer Information: This information can be completed during data entry and helps verify that all species recorded on the form are entered into the database.</i> | |
| Species/Sex count | Enter total number of species and sexes recorded during the haul. |
| 100% count | Enter total number of species and sexes whole-haul sampled during the haul. |
| Initial the circle in the bottom right corner of the form after data has been entered into the catch database. | |

Appendix B3.—Specimen collection form.

| | |
|---|--|
| Specimen collection form <i>R/V Resolution</i> | |
| Species (suspected): | |
| Date: | |
| Haul Number: | |
| General Location: | |
| Collector: | |
| Photo Taken? | yes no |
| file name and location: | |
| Reason for collection: | <input type="checkbox"/> Confirm ID <input type="checkbox"/> Special Project <input type="checkbox"/> Guide Inclusion other (specify) _____ |

Specimen collection form instructions

This form is completed and included in the sample bag of each specimen collected during the trawl survey.

Species (suspected) Species name or common name if known of animal collected. If the identification is in question, record the name of the possible identification based on preliminary examination.

Date Date animal was captured

Haul Number Sequential number for the haul animal was captured

General Location Nearest bay, headland, or gully

Collector Name of the person directing collection of the animal

Photo Taken?
Yes/No Circle whether a picture was taken

File name and location Where on the survey computer the picture file is saved.

Reason for collection Check the box with the reason the sample was collected. If a “Special Project” or “other”, specify the project or reason on the bottom line.

APPENDIX C. SHRIMP SAMPLING

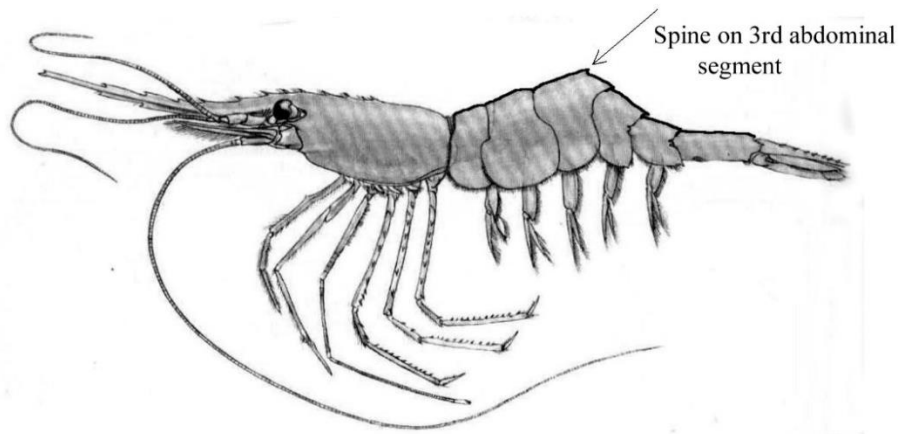




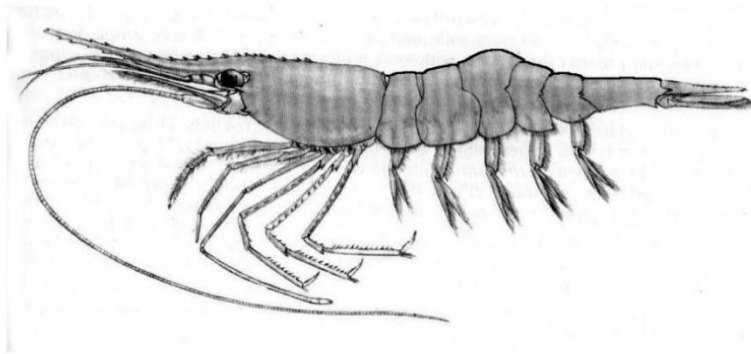




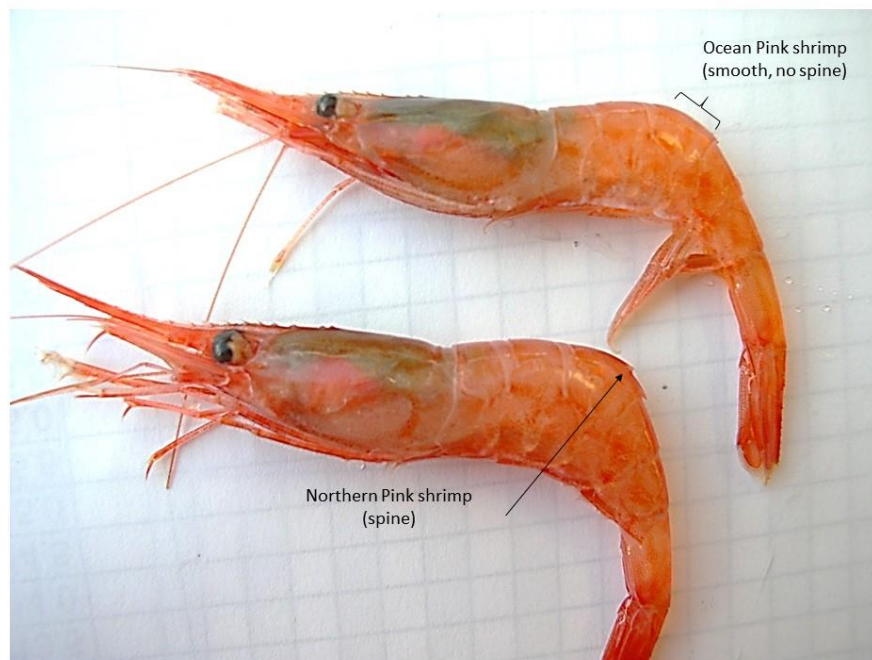
Appendix C2.–Differentiating ocean pink shrimp from northern pink shrimp.



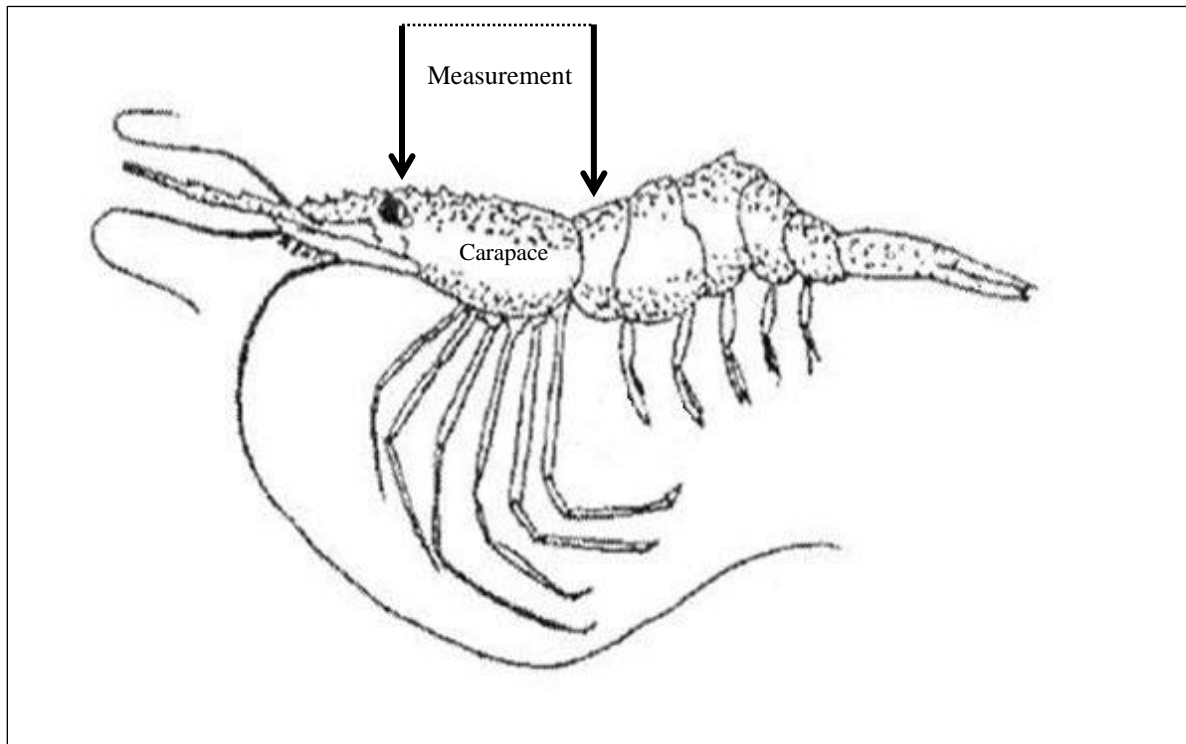
Northern Pink shrimp



Ocean Pink shrimp



Measure from the right eye socket to the posterior margin of the carapace.

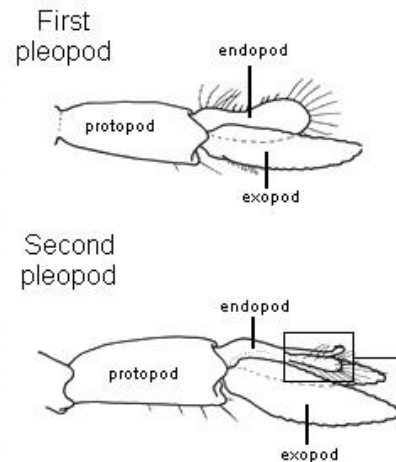
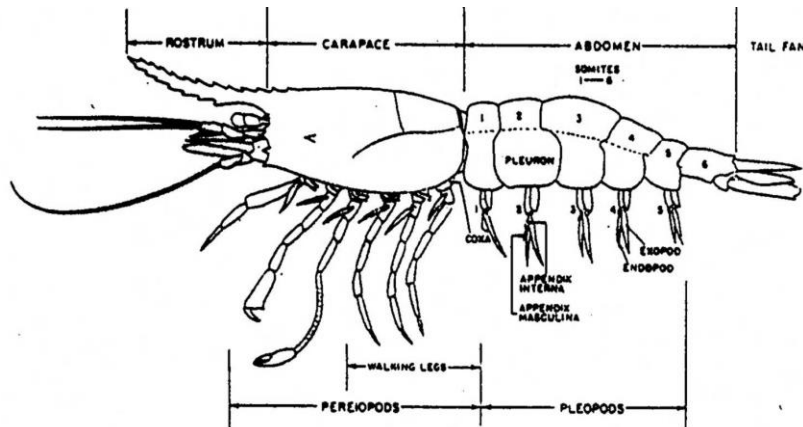


Appendix C4.–Sexing pandalid shrimp in the laboratory.

Pandalid shrimp in Alaska are typically protandric hermaphrodites, with three sexual phases identified: male, transitional, and female. Determining the sex of pandalid shrimp by examining sex organs is difficult and time consuming, but using the secondary sexual characteristic of endopod development, which closely tracks gonad development, allows sex to be determined easily and accurately. This method is the preferred procedure and is performed according to Butler's description in Shrimps of the Pacific Coast of Canada (1980).

Methodology

Isolate and examine the first and second pleopods.



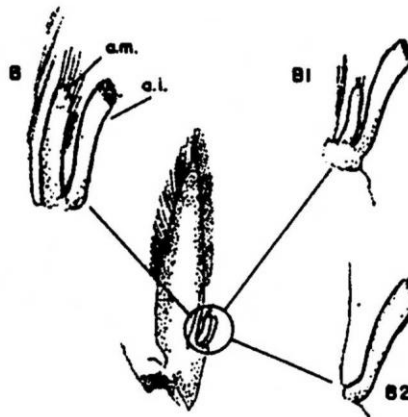
You may need to completely remove the exopods and examine the endopods against a dark background.

Examination of the endopod of the second pleopod:

- ♦ Males have two small processes nearly the same length branching from the basal inner margin of the endopod. The medial process, the appendix masculina, is distally spined. The lateral process is the appendix interna and is tipped with hook-like setae.
- ♦ A transitional phase has both processes with the appendix masculina clearly atrophied to approximately one-half (or less) the length of the appendix interna.
- ♦ Females have only the appendix interna, typically devoid of spines or setae. Ovigerous females are apparent by the presence of eggs.

Male phase:

Prominent appendix masculina with spines and prominent appendix interna



Transitional phase:

Appendix masculina atrophied to ½ the size of the appendix interna

Female phase:

Only the appendix interna is present.

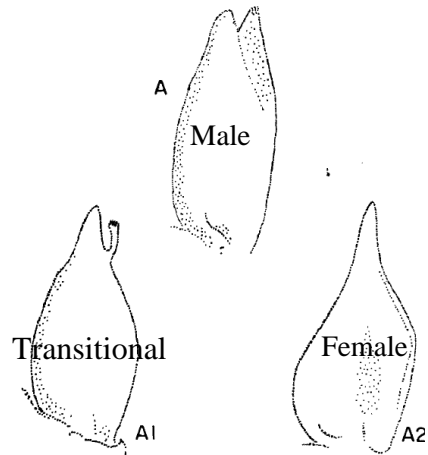
Endopod of second pleopod

-continued-

Examination of the endopod of the first pleopod:

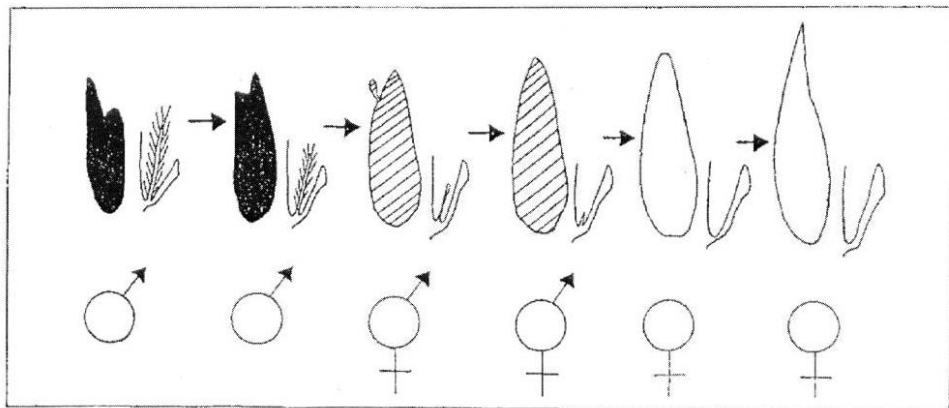
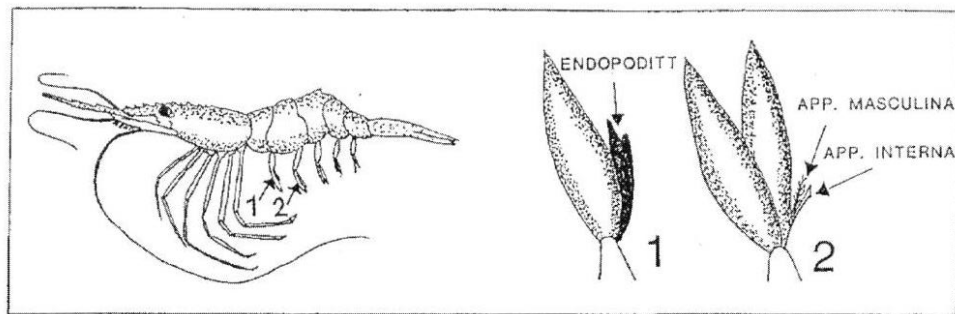
First endpod distal lobe characteristics:

- ♦ Males - bifid, equally lobed with a median cleft
- ♦ Transitional - on the medial edge near the tip, there will be a small rigid protuberance
- ♦ Female - the tip is flame shaped like the end of a quill and sharply pointed



Endopod of the first pleopod.

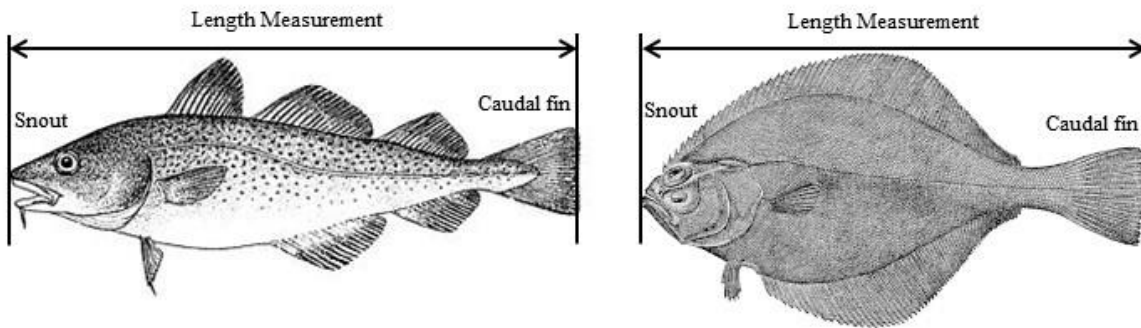
The transition from male to female is a process that may not be identical in all animals. It may be necessary to examine both the first and second pleopod to positively determine sex.



APPENDIX D. FISH AND JELLYFISH SAMPLING

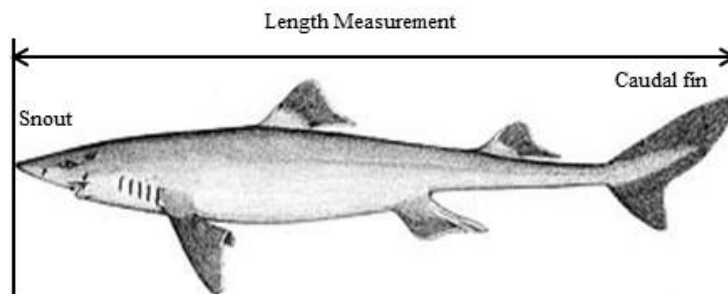
Finfish:

Snout to midpoint of caudal fin



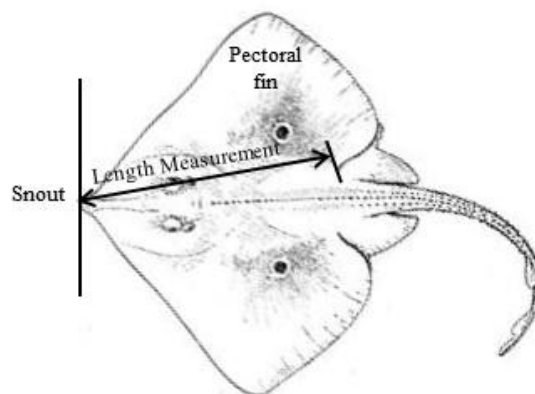
Sharks:

Snout to tip of caudal fin

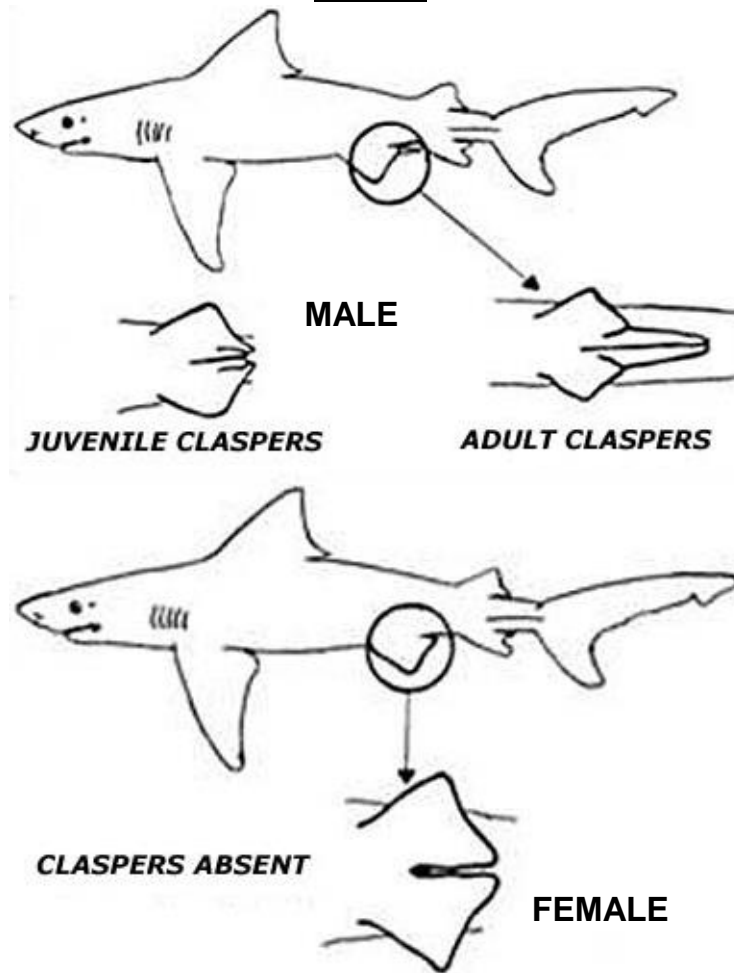


Skates:

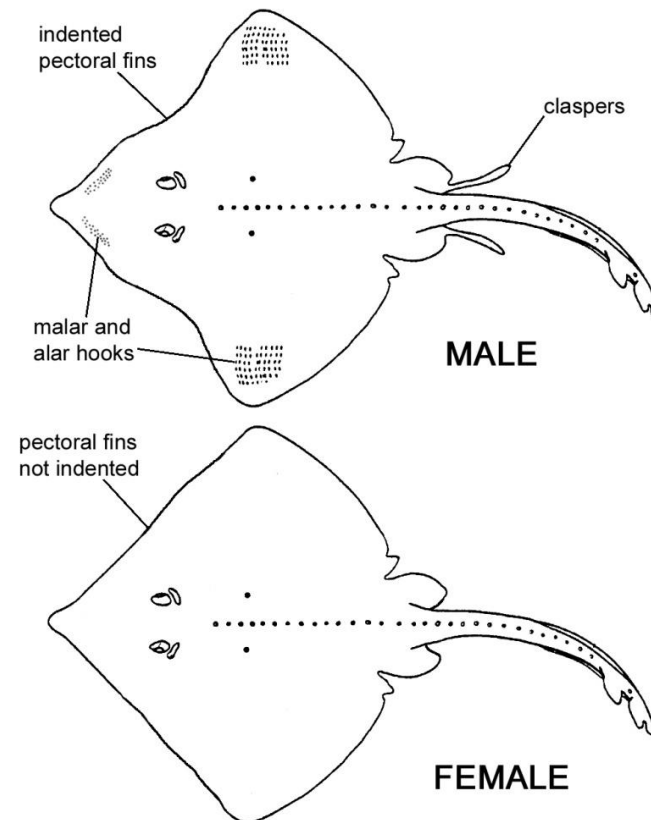
Snout to anterior notch of pectoral fin



Sharks



Skates



Appendix D3.—On-deck jellyfish identification photos.

